777a

ΑΠΕΙΡΕΣΙΑ:

Or, the whole DOCTRINE of

Decimal Arithmetick,

CONSISTING OF

Finite and *Infinite Fractions.*

MVSEVM BRITAN NICVM

AND CHIEFLY,

A new Way of working the Two Orders of INFINITES, ſuitable to their *Natures*; ſo that by two Places of either (equal to Ten Thouſand) every Operation will turn out a *juſt Solution*, without ſo much as one Figure or Cypher, more or leſs than the Truth, and is thereby the ſame with a *Finite* or *adequate Fraction.*

Compil'd, with all poſſible Plaineſs and Brevity, by

GABRIEL NISBET.

Ad ſocietatem & communitatem generis humani nati ſumus,
Itaque aliquid ad communem utilitatem debemus afferre.

CICERO.

EDINBURGH,
Printed by PATRICK MATTHIE in the *Luckenbooths*,
and Sold by moſt of the Bookſellers in this City and
Glaſgow, and is enter'd according to Act of Parliament.
MDCCXXXVIII.

To the Honourable,

Sir HANS SLOANE *Knight*, & Bar.t

Preſident of the Royal Society, &c.

FLATTERY (the Folly of the Age) is either a deceiving of ourſelves, or an impoſing on the Perſon we pretend to applaud.

AND ſeeing the greateſt Number of *Dedications* are generally look'd upon as ſuch, that this may not fall under the ſame Suſpicion, I have endeavour'd to avoid all unneceſſary Encomiums, ſuppoſing it rather the Buſineſs of an Undertaker, to addreſs his Patron as his Judge and Protector, than with a Deſign to flatter him into a good Opinion of the Work: For it requires a maſterly Hand to tranſmit to Poſterity the Actions of Great Men; and, as your ſuperior Virtues do infinitely tranſcend all that can be ſaid to recommend them, I ſhall not deſcend to Particulars, nor pretend an Encomium on a Character ſo univerſally eſtabliſhed as your's, and ſo often cut out in Capitals of Gold, as one of the moſt illuſtrious Sparkles of that celebrated SOCIETY, fitly compar'd to a curious Clock-work, where every Spoke and Spring are wind up into one another; or like a Set of harmonious Diapſons, ariſing from different Strings, with ſuch Harmony of Parts, that, in all their Deliberations, they appear to be but one concentrical Piece, or complex Body, girt about with the Cincture of Concord.

And, whatever may be the Sentiments of Mankind, with reſpect to real Merit, it is moſt certain, that where Ability is wanting to make ſuitable Returns, we ought, at leaſt, to trumpet the good Offices of our Benefactors, as an Acknowledgment in how far we are ſenſible of the ſmalleſt Obligation.

For, as nothing begets in us a Love to any Perſon, more than the Favours we have formerly receiv'd; ſo, from Experience, the Notice you was pleaſed to take of this Work, when recommeded to you in Manuſcript, and by you to your *Royal Society*, lays me under the ſtricteſt Obligation to acknowledge a Perſon, of whoſe Civility I had ſuch a ſingular Proof; ſo that I could not, in Conſcience, condeſcend on any one other than your ſelf, at whoſe Feet I would, with ſo much Satisfaction, lay the *following Treatiſe*: Which, tho' unworthy of ſuch a Patron, yet, as the Benefit of Mankind is the Buſineſs of your Life, and it is your Province to be ever Improving, the ſame powerful Protection will ſufficiently recommend it to the World, add to its intrinſick Worth, and even give Weight to a Matter of ſmaller Moment. And this being all the Return I can make, pardon the Preſumption of one who is ambitious to ſubſcribe himſelf,

Right Honourable,

Your humble and devoted Servant,

Gabriel Nisbet.

THE PREFACE.

MAN, whom GOD has deſigned a ſocial Creature, having created him with ſuch Wants and Demands about him, as, by the Conſtitution of his Nature, and the Situation of Things, caſts him upon human Care, and renders him an Object thereof; ſo that he cannot ſubſiſt in a State of Nature independent on the reſt of Mankind, but ſtands in Need of the Aid and Aſſiſtance of his Fellow Creatures; is bound, by the Law of Nature and Equity, to afford Aſſiſtance to others, as he needs, and expects the like from them. Hence it becomes an indiſpenſible Duty incumbent on all Men, to contribute towards the common Good, as their Abilities and Opportunities enable them. Non nobis nati ſumus, We were not born for our ſelves, but Man was born for the ſake of Man, *ſays* Cicero——— *It was the Conſideration of this alone that determin'd me to launch out into the World in Print, and no other Motive whatſoever could have made ſuch a weak Pen venture upon the Cenſure of a learned World, or ſubmit to the Tyranny of an invidious one——— And for that Purpoſe, I ſhall endeavour to deliver what I am to offer hereon with all poſſible Plainneſs and Brevity, and leave it a Pannel at the Bar of the impartial, tho' moſt penetrating Reader——— And firſt, (with Submiſſion to better Judgments) I conceive, that the Doctrine of* Infinite Fractions *has not hitherto been managed aright: For the firſt Claſs of Undertakers, conſidering them barely as* Finites, *and working them promiſcuouſly as ſuch, do thereby, in many Operations, fall a conſiderable Number of* Integers *ſhort, which, with* *other Fractional Defects, make a compleat Collection of Errors. And altho' there is no Need for Queſtions calculate on purpoſe, ſeeing every* Infinite *is an infallible Proof, yet the greater the* Integer *is, the farther are they from the true* Product. *For Inſtance, The* Infinite .88888, *multiplied by the* Integer 9000000000, *produceth* 80000 Integers *leſs than the right Solution, and what it would loſe in Geometrical Progreſſion, is obvious from that one Example.*

TO ſupply which Short-comings, the ſecond Claſs of Fractional Authors ſtop the Carreer of th Infinite, *by taking it a Time more in the 4th or 5th Place, than what it really is; ſo that the* Infinite .33, &c. *will then be* .3334, *and* .66 in infinitum *ſtand thus*, .66667, *which is* remedium morbo deterius, *it being as far over as the former was ſhort, as, out of an Infinity of Examples, will appear from thoſe following.*

EXAMPLE. At 2 ſh. $2\frac{2}{3}$ d. *the Pound Weight, what will* 9100 *Pound Weight give? The Decimal for* 2 ſh. $2\frac{2}{3}$ d. *is* .11, &c. *and in their Way* .1112, *which anſwers to* 1011.92, *and is* 16 ſh. 2 d. *more than* 1011.11, &c. *the true Product. So, by augmenting the* Integer, *you may increaſe the Error at Pleaſure, were it to any Number of Millions.* Exempli gratia, *The* Integer 75000000000000, *multiplying the* Infinite .88, *and with them* .8889, *produceth no leſs than* 833333333.3333 *more than the real Amount, or what it ought to be.*

AND by theſe erroneous Directions are ſo many Blunders committed in Calculation, wherever Infinites *occur, which is Ten Times for one* Finite; *they being for more numerous.*

BUT if, in Favour of the two former Methods, it ſhould be urged, That tho' they do not exactly hit, yet, by lengthening out the Infinite *to a certain Number of Places, as ſuppoſe Seven, or the like, they do,* quam proxime, *as near as could be wiſh'd, within, perhaps,* $\frac{1}{1000}$ *Parts of an* Integer, *which, ſay they, is inconſiderable. But this is alſo demonſtratively falſe; for tho' it hold in ſome ſingular Examples, yet there are an* Infinity *of others, which would each require an* infinite Number *of Places, and, after all, fall wide of the Truth.*

AND admit, by the foregoing Methods, they ſhould not err above the $\frac{1}{1000}$ *Part of an* Integer, *I muſt be excuſed for being of Opinion, that this Way of Working is better, which requires but two Places of* Infinites, (*equal to* 100000) *and gives a perfect Solution to every Queſtion, than thoſe which, after all the Places which can be employ'd, are either ſo much over, or ſhort thereof.*

AND this is the Deſign of the Work, and what has given Birth to the following Treatiſe; the Uſefulneſs of which I need be at no Trouble to illuſtrate, ſeeing Decimal Arithmetick *has its* Encomium *from every one but the Ignorant and Opinionative, Thouſands of Queſtions being ſolv'd by ocular Inſpection, only by the Artifice of ſhifting the Decimal Point to the Right or Left.*

AND here I would have the Reader obſerve, that beſides theſe Infinites *that are carried on in one continued Figure, as* .55, &c. *or uſher'd in by a certain Number of Digits, ſuch as* 5.833, in infinitum, *there are* Infinites *of a different Species, called* Circulating Infinites, *which are intirely new, as to any Notice that has been hitherto taken of them; for, upon Trial, I find, that every Decimal Fraction will either terminate in Cyphers, or be an Infinite of another Kind, if carried on till all the Viciſſitude of Places are exhauſted. And of ſuch are theſe,* .636363, *and ſo on, or,* .285714285714 in infinitum. *Of which Sort I have repeated the Circulation thrice in the firſt Line of each Table, and character'd every one of them with Aſteriſms, that they may be known for* Infinites, *and wrought as ſuch; but theſe prolix Caſes ſeldom occur in Practice.*

AS for the Treatiſe we are coming to, whether it ſhall have the deſigned Effect or not, is not for me to determine. Only this I know, that I have deſign'd well, and ſhall be glad, if, by this Eſſay, ſome abler Pen be ſpirited up to undertake a Work of ſuch univerſal Advantage. However it be, I am certain that Infinites, *as they are here handled, give a perfect Solution to every Queſtion as if they were adequate Fractions. And further, that every Fraction being either an adequate Fraction, or reducible to an Infinite reiterate or alternate, (which, by the following Method, are equivalent to an adequate Fraction) every Operation will turn out a perfect Anſwer, without ſo much as one Digit, or even a Decimal Place more or leſs than the Truth, which is all that can be deſir'd, and, if it were not too aſſuming, ſeems to be a* Ne plus ultra.

OF FRACTIONS IN GENERAL.

DEFINITION.

A FRACTION is one or more Parts of an Integer, according as the ſame is divided.

Every Fraction conſiſts of two Parts, a NUMERATOR, and a DENOMINATOR.

The *Denominator* is placed below the Line, and ſhows how many Parts the Integer is divided into.

The *Numerator* is plac'd above the Line, and denotes how many of the ſaid Parts expreſs'd by the *Denominator*, are contained in the Fraction. For Inſtance, the Vulgar Fraction $\frac{3}{4}\begin{array}{l}\textit{Numerator,}\\ \textit{Denominator,}\end{array}$ is read, Three Fourths of an Unite or Integer, and the Decimal $\frac{3}{10}$ thus, Three Tenths.

Of Decimal Fractions *in particular.*

DECIMAL derives its Original from the *Greek* Δέκα, Ten, becauſe it ſuppoſes its Integer divided into 10, 100, 1000, 10000, or any other Power of 10, which ſerve for Denominators to the Fraction, and muſt conſiſt of as many Cyphers as there are Places in the *Numerator*. Thus, the Numerator 25 will require a Denominator of 1 and 2 Cyphers, 356 of 3, 4978 of 4; and will ſtand thus, $\frac{25}{100}$, $\frac{356}{1000}$, $\frac{4978}{10000}$. So that the Denominator of the Decimal being always fix'd and certain, there's no Need it ſhould be expreſs'd, but may be underſtood: Whereby it is contradiſtinguiſh'd from the *Vulgar Fraction*, which having its Denominator uncertain and divers, cannot be underſtood, but muſt be expreſs'd. So $\frac{1}{10}$ may be plac'd without the Denominator, thus, .1, the Point being in the Tenth's Place, is ſignificant of it. After the ſame Manner $\frac{12}{100}$, or .12, $\frac{446}{1000}$, or .446, $\frac{3321}{10000}$, or .3321, &c.

As whole Numbers increaſe in a Decuple, or Tenfold Proportion, towards the Left-hand; ſo, on the contrary, Decimals decreaſe toward the Right-hand, in the ſame Proportion: As in the following *Scheme*.

TABLE *of* NOTATION.

INTEGERS.						DECIMALS.					
6	5	4	3	2	1	.2	3	4	5	6	7
Hundreds of Thouſands.	Tens of Thouſands.	Thouſands.	Hundreds.	Tens.	Unites.	Primes, or Tenths.	Seconds, or Hundredth Parts.	Thirds, or Thouſandth Parts.	Fourths, or Ten Thouſandth Parts.	Fifths, or Hundred Thouſandth Parts.	Sixths, or Millionth Parts.

Hence it appears, that, as in whole Numbers, the Order of Places is reckon'd from the Right towards the Left; ſo, on the contrary, in *Decimals*, it is reckon'd from the Left towards the Right. For Inſtance, 2468 is read 2 Primes, 4 Seconds, &c. And thus it is, that Cyphers annexed to the Right of whole Numbers, increaſe their Value in a decuple Proportion; yet neither increaſe nor decreaſe the Value of *Decimals*: So ,2 is 2 Primes, with Cyphers annexed to Infinity, ,20000000000000, &c. continues ſtill to be 2 Primes, as before. And the Reaſon is plain, becauſe $\frac{2000000000, \&c.}{10000000000, \&c.}$ is but equivalent to $\frac{2}{10}$ by that Rule * of Abbreviation

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* *I take it for granted, that the Reaſon of this Rule is underſtood by all who have learn'd Vulgar Fractions.*

breviation in Vulgar Fractions, of *cutting off an equal Number of Cyphers from Numerator and Denominator.* Thus, $\frac{200000000, \&c.}{1000000000, \&c.}$ abbreviated, is $\frac{2|00000000}{10|00000000}$ that is $\frac{2}{10}$. But on the contrary, Cyphers being placed on the Left of a Decimal, diminiſh its Value in a decuple Proportion: So 2 is 2 Primes; but, with a Cypher prefix'd, will be .02, that is, 0 Primes, 2 Seconds, Ten Times decreaſing in Value; for that $\frac{2}{10}$ is the Decuple of $\frac{2}{100}$ Parts. So that Decimals may be diſtinguiſhed from Integers by a *Comma*, *Point*, or any other *Sepatrix*.

DEFINITIONS.

I. A *Decimal Fraction* may be called *Finite*, or *Determinate*, when it has a determinate or limited Number of Figures, as .3, .45, .456.

II. A *Decimal Fraction* may be called *Infinite*, or *Indeterminate*, when the Number of Places is indeterminate, and is conceiv'd to have its Progreſs *in infinitum*. Thus, .333333333333, &c. .285714, 285714, 285714, &c.

III. Of *Infinites* there are two Species, which may be diſtinguiſhed by the Appellations of *Reiterating* and *Circulating Infinites*.

1. A *reiterating Infinite*, is that whoſe Infinity turns upon the ſame Figure, as .33333333333, &c. or, .04166666666, &c.

2. A *circulating Infinite*, is that which runs into Infinity, by a circulating Return of two or more Figures, as .285714, 285714, 285714, &c. or, .247,63, 63, 63, 63, &c.

Reduc-

Reduction of Decimals.

IN REDUCTION there are Three Caſes. I. To reduce a Vulgar Fraction to a Decimal. II. To reduce any Parts of an Integer to the Decimal Parts of its Integer. III. To find the Value of a Decimal in the known Parts of its Integer.

I. *To reduce a Vulgar Fraction to a Decimal.*

Rule. Add a competent Number of Cyphers to the Numerator, which being divided by the Denominator, point off as many Places from the Right of the Quotient as you add Cyphers; and where there are not ſo many, ſupply that Defect, before Pointing, by prefixing Cyphers to the Left.

1. *Examples of Vulgar Fractions into Finite Decimal Fractions.*

Reduce theſe Vulgar Fractions $\frac{13}{20}$, $\frac{9}{240}$, $\frac{3}{960}$, ſeverally into Decimals.

```
20)13.00(.65     240)9.0000(.0375     960)3.000000(.003125
   12 0              ----                 ----
   ----              1 800                1200
   1 00              -----                ----
   1 00              1200                 2400
   ----              ----                 ----
   0 00              0000                 4800
                                          ----
                                          0000
```

Anſwer. $\frac{13}{20}$ in Decimals is .65; $\frac{9}{240}$, .0375; $\frac{3}{960}$, .003125 in *Finite* Decimal Fractions.

2. *Examples of Vulgar Fractions into infinite Decimals.*

Reduce theſe Vulgar Fractions $\frac{6}{11}$ and $\frac{5}{120}$ ſeverally into Decimals.

11)6.000000(.545454, &c. 120)5.0000000(.0416666, &c.

Anſwer. $\frac{6}{11}$ in a Decimal, is .545454, &c. and $\frac{5}{10}$ is .0416666666 *infinite Decimal Fractions.*

II. *To reduce any Parts of an Integer to the Decimals of their Integer:* Whereby are diſcover'd the Decimal Tables of Reduction.

Rule. Bring the Parts condeſcended on to a Vulgar Fraction, by placing them as a Numerator, to the Number of Times one of them is contain'd in the Integer; Then, by the above Rule, reduce that Vulgar Fraction to a Decimal, and you have done.

1. *Examples of Parts* (*i. e.* leſſer Denominations) *into finite Decimals.*

Reduce 15 Shillings, 6 Pence, 3 Farthings, one by one, into the Decimals of a Pound.

A Shilling being the $\frac{1}{20}$ Part of a Lib. 15 Shillings will be $\frac{15}{20}$ Parts.	A Pence being the 240th Part of a Lib. 6 Pence will be $\frac{6}{240}$ Parts.	A Farthing being the 960th Part, 3 Farthings will be $\frac{3}{960}$ Parts.
20)15.00(.75	240)6.000(.025	960)3.000(.003125

2. *Examples.* Reduce 8 Shillings, 3 Pence, 3 Farthings, taken together, into the Decimal of a Pound.

In 8 Shillings, 3 Pence, 3 Farthings, there are 399 Farthings; and there being 960 Farthings in a Pound, 399 Farthings will be $\frac{399}{960}$ Parts of a Pound, as below.

$\frac{399}{960}$ 960)399.000000(.415625

II. *Examples of leſſer Denominations into Infinite Decimals.*

1. *Example.* A Day being the Integer, how are 8 Hours expreſs'd in Decimals?

The Hours in one Day being 24, it will ſtand in Vulgars thus, $\frac{8}{24}$.

24)8.000000(.333333 *in infin.*

2. *Example.* A *C.* Wt. being the Integer, what is the Decimal for 16 Pounds?

The Pounds in a *C.* Wt. being 112, gives for a Vulgar Fraction $\frac{16}{112}$.

112)16.00000000(.142857, 142857, 14, *&c.*

Let theſe ſuffice to ſhow how the following Tables of Reduction are attain'd, as they are inſert at large, on Purpoſe that they being always at Hand, may ſave the Practitioner the Expence of Time and Trouble, in calculating the Decimal Fractions (which occur in any Operation) before he can enter on the Work. The Method of reducing ſuch to their true Value, which is the Third Caſe, falls in naturally after the Tables, and will ſerve for a Proof and Explanation of theſe Tables.

DECIMAL TABLES.

I. TABLE.

Of MONEY.

A *Pound* the Integer.

ſh.	Dec.
1	.05
2	.1
3	.15
4	.2
5	.25
6	.3
7	.35
8	.4
9	.45
10	.5
11	.55
12	.6
13	.65
14	.7
15	.75
16	.8
17	.85
18	.9
19	.95

d.	Decimals.
1	.0041666
2	.008333
3	.0125
4	.016666
5	.020833
6	.025
7	.029166
8	.033333
9	.0375
10	.041666
11	.045833

far.	Decimals.
1	.00104166
2	.00208333
3	.003125
½	.000520833

II. TABLE.

TROY WEIGHT.

A *Pound Weight* the Integer.

Ounc.	Decimals
1	.0833333
2	.1666666
3	.25
4	.3333333
5	.4166666
6	.5
7	.5833333
8	.6666666
9	.75
10	.8333333
11	.9166666

Nota, *This Table of Ounces will alſo ſerve for Months, Dozens, or Inches.*

P.wts	Decimals
1	.0041666
2	.0083333
3	.0125

P.wts.	Decimals.
4	.0166666
5	.0208333
6	.025
7	.0291666
8	.0333333
9	.0375
10	.0416666

Gr.	Decimals.
1	.0001734375
2	.000346875
3	.0005203125
4	.00069375
5	.0008671875
6	.001040625
7	.0012140625
8	.0013875
9	.0015609375
10	.001734375
20	.00346875
½	.00008671875

DECIMAL TABLE.

III. TABLE.

Of Tro~~y~~as, or Common Weight.

A *Pound* the Integer.

Ounces.	Decimals.
1	.0625
2	.125
3	.1875
4	.25
5	.3125
6	.375
7	.4375
8	.5
9	.5625
10	.625
11	.6875
12	.75
13	.8125
14	.875
15	.937

Drams.	Decimals.
1	.00390625
2	.0078125
3	.01171875
4	.015625
5	.01953125
6	.0234375
7	.02734375
8	.03125
9	.03515625
10	.0390625
11	.04296875
12	.046875
13	.05078125
14	.0546875
15	.05859375

Grains.	Decimals.
½	.0000542534722
1	.000108506944
2	.000217013888
3	.000325520833
4	.000434027777
5	.000542534722
6	.000651041666
7	.000759548611
8	.000868055555
9	.000976562499
10	.00108506944
20	.00217013888
30	.00325520833

DECIMAL TABLES.

I. TABLE.

Of Money.

A *Pound* the Integer.

ſh.	Dec.
1	.05
2	.1
3	.15
4	.2
5	.25
6	.3
7	.35
8	.4
9	.45
10	.5
11	.55
12	.6
13	.65
14	.7
15	.75
16	.8
17	.85
18	.9
19	.95

d.	Decimals.
1	.0041666
2	.008333
3	.0125
4	.016666
5	.020833
6	.025
7	.029166
8	.033333
9	.0375
10	.041666
11	.045833

far.	Decimals.
1	.00104166
2	.00208333
3	.003125
½	.000520833

II. TABLE.

Troy Weight.

A *Pound Weight* the Integer.

Ounc.	Decimals
1	.0833333
2	.1666666
3	.25
4	.3333333
5	.4166666
6	.5
7	.5833333
8	.6666666
9	.75
10	.8333333
11	.9166666

Nota, *This Table of Ounces will alſo ſerve for Months, Dozens, or Inches.*

P.wts	Decimals
1	.0041666
2	.0083333
3	.0125

P.wts.	Decimals.
4	.0166666
5	.0208333
6	.025
7	.0291666
8	.0333333
9	.0375
10	.0416666

Gr.	Decimals.
1	.0001734375
2	.000346875
3	.0005203125
4	.00069375
5	.0008671875
6	.001040625
7	.0012140625
8	.0013875
9	.0015609375
10	.001734375
20	.00346875
½	.00008671875

DECIMAL TABLE.

III. TABLE.

Of Tro~~y~~as, or Common Weight.

A *Pound* the Integer.

Ounces.	Decimals.
1	.0625
2	.125
3	.1875
4	.25
5	.3125
6	.375
7	.4375
8	.5
9	.5625
10	.625
11	.6875
12	.75
13	.8125
14	.875
15	.937

Drams.	Decimals.
1	.00390625
2	.0078125
3	.01171875
4	.015625
5	.01953125
6	.0234375
7	.02734375
8	.03125
9	.03515625
10	.0390625
11	.04296875
12	.046875
13	.05078125
14	.0546875
15	.05859375

Grains.	Decimals.
½	.0000542534722
1	.000108506944
2	.000217013888
3	.000325520833
4	.000434027777
5	.000542534722
6	.000651041666
7	.000759548611
8	.000868055555
9	.000976562499
10	.00108506944
20	.00217013888
30	.00325520833

DECIMAL TABLE.

IV. TABLE.

Of TIME.

A *Day* the Integer.

Hours.	Decimals.	Minutes.	Decimals.
1	.0416666	1	.00069444
2	.0833333	2	.00138888
3	.125	3	.00208333
4	.1666666	4	.00277777
5	.2083333	5	.00347222
6	.25	6	.00416666
7	.2916666	7	.004861111
8	.3333333	8	.00555555
9	.375	9	.00625
10	.4166666	10	.00694444
11	.4583333	20	.01388888
12	.5	30	.02083333
13	.5416666	40	.02777777
14	.5833333	50	.03472222
15	.625		
16	.6666666		
17	.7083333		
18	.75		
19	.7916666		
20	.8333333		
21	.875		
22	.9166666		
23	.9583333		

Nota, *For any Number you want, which, for Brevity's ſake, is not here, add the Parts of ſuch 2 or 3 Numbers together as will compoſe it, and the Total is the Decimal ſought.*

DECIMAL TABLE.

V. TABLE. *Of* AVOIRDUPOISE, Greater Weight.

The Integer being a *C. Weight*, or 112 Pounds

Quarters.	Decimals of a *C.* Weight.
1	.25
2	.5
3	.75

Pounds.	Decimals of a *C.* Weight.
1	.0089 * 285714 * 285714 * 285714 *, &c.
2	.017 * 857142 * 857142 *, &c.
3	.0267 * 857142 *, &c.
4	.03 * 571428 *, &c.
5	.0446 * 428571 *, &c.
6	.053 * 571428 *, &c.
7	.0625.
8	.071 * 428571 *, &c.
9	.0803 * 571428 *, &c.
10	.089 * 285714 *, &c.
11	.0982 * 142857 *, &c.
12	.10 * 714285 *, &c.
13	.1160 * 714285 *, &c.
14	.125
15	.1339 * 285714 *, &c.
16	.* 142857 *, &c.
17	.1517 * 857142 *, &c.
18	.160 * 714285 *, &c.
19	.1696 * 428571 *, &c.
20	.17 * 857142 *, &c.
21	.1875
22	.196 * 428571 *, &c.
23	.2053 * 571428 *, &c.
24	.2 * 1428571 *, &c.
25	.2232 * 142857 *, &c.
26	.232 * 142857 *, &c.
27	.2410 * 714285 *, &c.

DECIMAL TABLES.

VI. TABLE.

Of Dry Meaſure.
The Integer a *Boll.*

Firlots.	Decimals.
1	.25
2	.5
3	.75

Pecks.	Decimals
1	.0625
2	.125
3	.1875

Lipp.	Decimals.
1	.015625
2	.03125
3	.046875
½	.0078125

Note, *This Table likewiſe ſerves for the Table of Long Meaſure, the Integer* one Yard *or* Ell.

VII. TABLE.

Of Liquid Meaſ.
The Int. a *Gallon.*

Pints.	Decimals.
1	.125
2	.25
3	.375
4	.5
5	.625
6	.75
7	.875

Mut.	Decimals.
1	.03125
2	.0625
3	.09375

Gills.	Decimals.
1	.0078125
2	.015625
3	.0234375
½ Gill.	.00390625

VIII. TABLE.

Of Glaſs Meaſ.
The Int. a Foot of 8 Inches.

Inch.	Decim.
1	.125
2	.25
3	.375
4	.5
5	.625
6	.75
7	.875

Quar.	Decim.
1	.03125
2	.0625
3	.09375
⅛ Inch	.015625

Nota, *The above is much the ſame with the former, and may be omitted.*

Explanation. One Column in each Table contains either the Number of *Hours*, *Pints*, *Quarters*, *Inches*, or any Thing elſe you want, and oppoſite thereto their proper Decimals: As is clear from the *Third Caſe* of *Reduction*, which is as follows.

III. *Caſe* of *Reduction*, viz. *To find the Value of any Decimal in the known Parts of its Integer.*

Rule. Multiply the Fraction by the known Parts of the Integer; that is to ſay, if it be the Decimal of *L. Sterling*, multiply it by 20 for *Shillings*, by 12 for *Pence*, and by 4 for *Farthings*; and ſo of any other, conform to their univerſal Tables. And having pointed off as many from each Product, as you have Decimals in the *Multiplicand*, theſe to the Left of the Point are the Parts requir'd; and to the Right thereof ſtands their proper Decimals. *Exempli cauſa*, What is the Value of 975 of a *Pound Sterling*, and of 5515625 of a *Pound Troy*?

1. *Example.*		2. *Example.*	
L.	.975	Pounds,	.5515625
	20		12
ſh.	19.500	Ounces,	6.6187500
	12		20
d.	6.0	P. Wt.	12.37500
			24
			1500
			750
		Grains,	9.000

For Examples of *Infinites*, we refer the Reader to the following Rules, and for Inſtances of the above, to the *Practice* of *Multiplication*, ſeeing the Directions for the Work, which are peculiar to the Rules, cannot be included here.

Addi-

Addition of *Decimals.*

ADDITION is the finding one Number, equal to two or more Numbers taken all together; that is, finding the moſt ſimple Expreſſion of a Number containing as many Unites, or Parts of Unity, as there are in all the given Numbers taken together; which is hence call'd the *Sum*, *Total*, or *Aggregate* of theſe Numbers.

GENERAL RULE.

Having plac'd Unites under Unites, and Primes under Primes, work the *Finites* as whole Numbers, always remembring to affix the Decimal *Sepatrix*, to diſtinguiſh the Integers from their Parts: But if they be *Infinites*, or *mixt Numbers*, that is, compos'd of *Finites* and *Infinites*, then lengthen out the Infinite, at leaſt two Places, if a *Reiterate*, and two *Circulations*; if a *Circulate*, further than the longeſt *Finite*; and inſtead of bearing One for each Ten in the Extreme Rank, to the right Hand, carry One for each Nine, ſetting down the Overplus of Nine or Nines. And here it is to be remarked, once for all, That both the *Infinites*, *Reiterating* and *Circulating*, obſerve the ſame Rules in *Addition*, *Subſtraction*, *Multiplication*, and *Diviſion*; only with this Difference, That inſtead of borrowing One for each Nine, *&c.* in the *Reiterate*, in the *Circulate* you continue it for two Circulations, or ſo, and regulates the one *Circulation* by the other: And where two *Circulations* are uot ſufficient (which, I believe, ſcarce ever happens) to diſcover how the *Circulate* runs, repete the *Circulation* for another Time.

Reaſon of this Rule, to be obſerved thro' the whole of Infinite Decimal Fractions.

It is to be noted, that we, all along, thro' the whole of the Work, proceed by this *Maxim*, namely, That *Infinites*, whether reiterate or circulating, *be not cut off in their Infinity.*

nity. For this Reaſon it is, that we carry One for each Nine in the extreme Rank in *Addition*, borrow Nine in *Subſtraction*, fill up the Blanks of the retiring Multipliers in *Multiplication*, and reiterate or circulate in *Diviſion*, to the End that the *Infinite* may not be cut off, but continued.

I. *Caſe*, is *Finite Decimals*.

L.	ſh.	d.		L.
444	17	6		444.875
136	15	9		136.7875
222	19	3		222.9625
555	5	0	In Decimals, are	555.25
666	14	6		666.725
823	0	9		823.0375
9	9	0		9.45
2859	1	9		2859.0875

In *Vulgars*, the *Sum aggregate* is 2859 L. 1 ſh. and 9 d. In *Decimals*, L. 2859.0875, which 0875 will, by the Third *Caſe* of *Reduction*, be found to be 1 ſh. and 9 d.

II. *Caſe*, is *Infinites*.

1. *Example*, Of the *Reiterate*.

L.	ſh.	d.	f.		
223	15	2	0		223.75833333
321	10	8	2		321.53541666
211	6	0	1	In Decimals,	211.30104166
333	9	0	1		333.45104166
222	18	5	0		222.92083333
398	1	4	0		398.06666666
1711	0	8	0		1711.03333333

Aggregate in *Vulgars*, L. 1711, and 8 d. In *Decimals*, L. 1711, and .0333, *&c.* which is 8 d. juſt.

2. *Example.* Of the *Circulate* in *Avoirdupoiſe*, Greater Wt.

C.	Qrs.	L.		C.
24	1	2		24.267857142857142 *
3	2	2	In Decimals,	3.517857142857142 *
23	3	8		23.82142857142857 * 1
2	2	6		2.5535714285714 28*
54	0	18		54.160714285714285 *

54 C. and 160 * 714285 * 714285 * 71, &c. equivalent to 18 L. juſt.

III. *Caſe*, is *Mix'd Numbers.*

31	0	10		31.04166
92	3	10		92.19166
94	5	0		94.25
95	0	4	In Decimals,	95.01666
92	5	4		92.26666
13	0	8		13.03333
21	19	0		21.95
439	15	0		439.75=15 ſh. juſt.

Subſtraction of Decimals.

SUBSTRACTION is the taking one Number out of another, or finding the Difference between any two Numbers; *i. e.* the moſt ſimple Expreſſion of that Number, whereby the Greater of two Numbers exceeds, or the Leſſer comes ſhort of another.

The *Rule* here is the ſame as in *Addition*, *viz.* Lengthening out the *Infinite* two Places further than the longeſt *Finite*, and borrowing 9 to the extreme Rank, and carrying on the *circulating Infinite* to two Circulations, (if there ſhall be Occaſion) in order to a Regulation.

I. *Caſe*, is *Finites*.

From L.	559	15	0	In Decimals,	559.75
Deduct	228	19	6		228.975
	330	15	6		330.775

Remains in *Vulgars*, 330 L. 15 ſh. 6 d. in *Decimals*, L. 330.775. which .775 is equivalent to 15 ſh. 6 d.

II. *Caſe*, is *Infinites* in the *Charge*.

Charge	6423	13	4	In Decimals,	6423.666666
Diſcharge	4377	17	9		4377.8875
Balance	2045	15	7		2045.779166, &c.

III. *Caſe*, is *Infinites* in the *Diſcharge*.

1. *Example*.

Charge	876	18	3	In Decimals,	876.9125
Diſcharge	678	6	8		678.333333
Balance	198	11	7		198.579166, &c.

Balance in *Decimals*, L. 198.579166, &c. which .579166 is equal to 11 ſh. 7 d. juſt.

2. *Example*.

C.	Qrs.	L.		C.
22	2	7	In Decimals,	22.5625
12	3	6		12.803 * 571428571428 *
9	3	1		9.75892857142857, &c. = 9 C. 3 Quarters, and 1 L. juſt.

IV. *Caſe*, is *Infinites*, in both *Charge* and *Diſcharge*.

1. *Example.*

L.	ſh.	d.	f.		L.
236	6	8	0	In Decimals,	236.3333333
13	15	5	2		13.7729166
222	11	2	2		222.5604166, &c.

Balance in *Decimals*, L. 222.5604166, &c. which 5604166666 is equivalent to 11 ſh. 2 d. 2 f. juſt.

2. *Example.*

C.	Qrs.	L.		C.
22	2	26	In Decimals,	22.732142857142857, &c.
2	3	27		2.991071428571428, &c.
19	2	27		19.741071428857142, &c.

Balance in *Vulgars*, 19 C. 2 Quarters, and 27 Pounds. In *Decimals*, C. 19.7410714, &c. which .74107142857I4, &c. is equal to 2 Quarters, 27 Pounds, juſt.

Multiplication of *Decimals*.

MULTIPLICATION is, the taking any Number a certain propos'd Number of Times.

I. *Caſe*, with *Finites*, in both *Multiplicand* and *Multiplier*.

The *Rule*. *Finites* are wrought as *whole Numbers*, pointing off for Decimals as many Places in the *Product*, as there are Decimals both in *Multiplicand* and *Multiplier*; but if there are not ſo many, ſupply that Deficiency by affixing Cyphers to the Left.

1. *Example.*		2. *Example.*	
Multiplicand	2.775	*Multiplicand*	.375
Multiplier	1.25	*Multiplier*	.05
	13875		.001875
	5550		
	2775		
	3.46875		

To multiply by 10, 100, 1000, 10000, &c. or any other Power of 10, is only removing the *Sepatrix* as many Places towards the Right as there are Cyphers.

Multiplicand	296843287345
Multiplier	10000
Facit	29684328673.45

II. *Caſe*, is one of the Numbers given an *Infinite*.

Rule. Make the *Infinite* the *Multiplicand*, and inſtead of carrying 1 for each 10 in the Extremities of each *Multiplier's Product*, carry 1 for each 9, aud then add up according to the Rules of *Addition*, after having filled up the Blanks of the retiring Multipliers, by reiterating, if it be a *reiterating Infinite*. But if it be a *circulating* one, let theſe Blanks be filled up by repeating the Circulation; ever remembring to regulate the one Circulation by the other, as has been ſaid before. And here in *Multiplication*, as well as in other Rules, 'twill be obſerv'd, that two Places of Infinites are as ſufficient as Ten Thouſand.

1. *Example.* Multiply 4 L. 10 d. by 2 L. 4 ſh.

4.04166, &c.
2.2

808333, &c.
8083333, &c.

8.891666, &c.

Proof by Vulgar Fractions.

L. ſh. d.
4 0 10 $= 4\frac{10}{240} = \frac{970}{240}$
2 4 00 $= 2\frac{4}{20} = \frac{44}{20}$ X $\frac{970}{240} = \frac{42680}{4800} =$ 8.89166, &c.

Quod erat probandum.

2. *Example.* Multiply 4 C. Weight, 16 Pound, *Avoirdupoiſe*, by 6 L. 8 ſh.

4.142857142857, *
6.4

16571428571428
24857142857142

26.5142857142857, &c.

Proof by Vulgar Fractions.

C. 4 16 L. $= 4\frac{16}{112} = \frac{464}{112}$
L. 6 8 ſh. $= 6\frac{8}{20} = \frac{128}{20}$ X $\frac{464}{112} = \frac{59392}{2240} =$ 26.514287.
142857142 *, &c. *Quod erat probandum.*

Nota bene, If the *Multiplier* terminate in Cyphers, inſtead of ſetting down the Cyphers, reiterate the laſt Figure of the Product. For Inſtance, multiply 6 ſh. 8 d. by 220.

.33 6 ſh. 8 d. $= \frac{80}{240}$
220

---

66 220 $= \frac{220}{1}$ X $\frac{80}{240} = \frac{17600}{240} =$ 73.333, &c.
666 *Quod erat probandum.*

73.33

III. *Caſe*, is the *Multiplicand* and *Multiplier*, both *Infinites.*

Rule. Set off the reiterating Figures in the *Multiplier* to the Right, and if they be 3's, place down the third Part of the *Multiplicand*; if 6's, the Third twice. But if the *Infinity* of the *Multiplier* conſiſt in any other Figure, take the 9th Part, which multiply by the reiterating Figure in the *Multiplier*: This done, proceed with the other Figures in the *Multiplier*, if there be any, as in *Multiplication*, always remembring, in pointing off, not to reckon the reiterating Figures in the *Multiplier*.

Example 1. Let it be requir'd to multiply 6 L. 1 d. by 2 L. 6 ſh. 8 d.

6.004166, &c.
2.33, &c.

$\frac{1}{3}$=2001388
12008333

14.009722, &c.

Proof by Vulgar Fractions.

$6 \quad 0 \quad 1 = 6\frac{1}{240} = \frac{1441}{240}$

$2 \quad 6 \quad 8 = 2\frac{80}{240} = \frac{560}{240} \times \frac{1441}{240} = \frac{806960}{57600} = 14.009722$, &c.

Quod erat probandum.

Example 2. Multiply 2 ſh. 2 d. by 13 ſh. 4 d.

.10833, &c.
.66

$\frac{1}{3}$ 3611
$\frac{1}{3}$ 3611

.07222, &c.

Proof by Vulgar Fractions.

ſh. d.

$2 \quad 2 = \frac{26}{240}$.

$13 \quad 4 = \frac{160}{240} \times \frac{26}{240} = \frac{4160}{57600} = .07222$, &c. *Quod erat proban.*

Example 3. Multiply 16 Minutes by 6 Hours 8 Minutes, a *Day* the Integer.

.0 11, &c.
.255, &c.

$\frac{1}{9}$=0*012345679*012345679*, &c.
5

00*61728395 0*61728395, &c.
02 22222222 2 22222222

.002 83950617 2 83955617, &c.

Here, becauſe there are not ſo many Places in the *Product*, as there are Decimals in *Multiplicand* and *Multiplier*, (not reckoning the Set of *Infinites*) a Cypher is prefix'd for ſupplying that Deficiency, as has been ſaid already.

PROOF.

16 Minutes $= \frac{16}{1440}$

6 Hours, 8 Min. $= \frac{368}{1440} \times \frac{16}{1440} = \frac{5888}{2073600} =$ .0028395061 7 *

Practical Multiplication.

Queſt. 1. WHat is the Value of the *Infinite Decimal* .666 of a Pound?

L. .66, &c.
20

ſh. 13.33, &c.
12

66
333

d. 4.00

Queſt. 2. What is the Value of the *Infinite* .*142857* 142857 * of a *C.* Weight ?

C. Weight, .142857142857
4

Quarters, .571428571428
28

4571428571428
1142857142857I

Pounds, 16.000000000000

Queſt. 3. At 16 ſh. and 8 d. the Yard, what will 68 Yards, 2 Quarters coſt ?

.833, *&c.*
68.5

4166
66666
500000

Facit 57.0833, *&c.* = 57 L. 1 ſh. 8 d. juſt.

Queſt. 4. At 1 L. 1 ſh. or 1.05 *Sterling* in a *Guinea*, how many L. *Sterling* in 160 *Guineas ?*

160
1.05

800
160

168.00 L. *Sterling* for Anſwer.

Queſt. 5. At 12 L. 12 ſh. *Scots*, or 12.6 in a *Guinea*, how many L. *Scots* in 160 *Guineas*?

```
   160
  12.6
  ----
   960
  320
 160
  ----
2016.0 L. Scots, for Anſwer.
```

Queſt. 6. At 2 L. 18 ſh. the *Rix Dollar*, how many L. in 32 *Rix Dollars*, a Half, a Third, and a Fourth Part?

```
       33.0833, &c.
            2.9
       -------
       2977500
       6616666
       -------
Facit  95.94166, &c. = 95 L. Scots, 18 ſh. and 10 d.
```

Queſt. 7. At 1.5 Merks in a Pound *Sterling*, or *Scots*, how many Merks in 50 L. 6 ſh. 8 d.?

```
 50.33, &c.
   1.5
 -----
 25166
 50333
 -----
75.500 = 75 Merks and an Half.
```

Queſt. 8. At 4.5 Merks in a *Crown*, how many Merks in 346¾ *Crowns*?

```
  346.75
     4.5
  ------
  173375
  138700
  ------
1560.375=1560 Merks, and 5 ſh.
```

And here it is to be obſerved, That in the above or like Examples, you are to multiply the Number aſſign'd by one of its own Sort, as it makes, and is expreſſed. For *Example*, There being 4.5 Merks in one Crown, therefore any Number of Crowns, multiply'd by 4.5, gives the Anſwer in Merks and Parts; and ſo of any other, conform to the Number of Times one of the Leſſer is contain'd in one of the Greater. Then, for diſcovering the Fraction of a Merk, the Rule is, Multiply it by 13 ſh. and 4 d. or .66, &c. that gives the Decimal of a Pound, and that by 20, and 12, &c. gives the Shillings and Pence contain'd therein.

Queſtions of *Diviſion* may, by Decimals, be perform'd by *Multiplication*, as the two following.

Queſt. 9. At 13 ſh. 4 d. or .66, &c. in the Merk, how many L. *Sterling*, or *Scots*, in 1512.5 Merks?

.66, &c.		1512.5
1512.5		66, &c.
333		⅓=504166
1333	Or,	⅓=504166
6666		
333333		1008.333, &c.
666666		
1008.333		

Anſw. In 1512.5 Merks, there are 1008 L. 6 ſh. 8 d. *Sterling* or *Scots*.

Queſt. 10. In 20713½ Merks *Scots*, how many Pounds *Sterling*, at .055, &c. Pounds *Sterling* in the Merk?

20713.5		.055, &c.
.055, &c.		20713.5
⅑ 23015	Or,	277
5		1666
		5555
1150.75		388888
		11111111
		1150.7500

Anſw. Either Ways, 1150 L. 15 ſh. *Sterling.*

Nota, The two foregoing and other Examples, uſually perform'd by *Diviſion*, how they are here equally wrought by *Multiplication* in Decimals, may be accounted for as follows.

The Decimal .5, is the Half, or $\frac{1}{2}$ Part of any Integer. .25 is the Fourth, and .75 is the $\frac{3}{4}$: So that any Number, or Sum of Integers or Fractions, multiplied by the $\frac{1}{2}$ Part of an Integer, makes the Multiplicand $\frac{1}{2}$ leſs; multiplied by $\frac{1}{3}$, makes the Multiplicand $\frac{1}{2}$ leſs. So, if 24 L. be multiplied by $\frac{1}{4}$ L. or, in Decimals, .25, the Product is 6 L. and 15 ſh. which is $\frac{3}{4}$ L. multiplied by $\frac{1}{3}$ of a Pound, the Product is .25, or $\frac{1}{4}$ L. Thus, multiplying a Number by $\frac{1}{2}$, is all one as dividing by 2; multiplying by $\frac{1}{3}$ is equivalent to dividing by 3, and multiplying theſe *Decimal Infinites, to wit*, .66, *&c.* and .055, *&c.* by any Number of Merks, *&c.* is the ſame as dividing theſe Merks by 1.5 for L. *Scots*, or 18 for L. *Sterling.*

Queſt. 11. A certain Merchant venturing to the *Fiſhing*, freights a Ship, and pays of Freight 666 L. 13 ſh. 4 d. He pays for *Salt* and *Tree*, 2333 L. 6 ſh. 8 d. for *incident Charges*, 566 L. 8 ſh. He makes 6800 Sale Fiſh, and ſells them at 24 L. 13 ſh. 4 d. the Hundred. He makes 466$\frac{1}{2}$ Barrels *Herring*, and ſells them at 11 L. 6 ſh. 8 d. The Queſtion is, whether he gain'd or loſt, and how much?

Expences.	
666.66, *&c.*	24.66, *&c.*
2333.33, *&c.*	68
566.4	
3566.40	19733
	148000
	L. 1677.33, *&c.* got for *Fiſh.*

```
        11.33, &c.
        466.5
      ———————
        5666
        68000
        680000
        4533333
      ———————
```

Got for *Herrings*, 5287.000 L.

He got for *Fiſh*, 1677.33, &c.
He got for *Herrings*, 5287.

Got in all, 6964.33, &c.
Gave out in all, 3566.4

Gain'd in all, 3397.9333, &c.

Anſw. He gain'd in all, 3397 L. and .933, &c. = 18 ſh. and 8 d. juſt.

Diviſion of *Decimals*.

DIVISION findeth how oft one Number is contain'd in another.

Diviſion in *Decimals* differeth little from *Diviſion* of *whole Numbers*; only in *Integers*, the *Dividend*, or Number to be divided, is always preſum'd to be greater than the *Diviſor*, but here it is ſometimes leſs. In which Caſe, the *Dividend* is to be prepar'd by annexing a competent Number of Cyphers, if it be a *Finite*; but if an *Infinite*, by reiterating, and then proceed by the Rules peculiar to each Caſe.

I. *Caſe*, is *Infinites* in both *Dividend* and *Diviſor*, or in the *Dividend* only.

General Rule. Having divided according to the Rules of *Diviſion* of *Integers*, for diſcovering the Value of the *Quotient*, point off as many for Decimal Parts, as the Dividend has Decimals more than the Diviſor; and where it has not ſo many, ſupply that Deficiency by Cyphers to the Left.

I. *Examples* having their *Dividends* and *Diviſors* both *Finites*.

1. *Example.* The *Dividend* greater than the *Diviſor*, which is 18346.5, given to be divided by 283.125.

```
Diviſor.  Dividend.  Quotient.
283.125)18346.5000(64.8
        1698750
        -------
         1359000
         1132500
         -------
          2265000
          2265000
          -------
```

2. *Example.* The *Dividend* leſs than the *Diviſor*, viz 1 given to be divided by 220, as alſo, .828125 by 12.

```
220)1.000000(.004545 *, &c.
    880 . . .
    ------
    1200
    1100
    ------
     1000
      880
    ------
     1200
     1100
    ------
      100
```

12)

```
12).828125000000(.069010416666, &c.
    72
   ---
    108
    108
    ---
     012
      12
      ---
       050
        48
        ---
         20
         12
         --
          80
          72
          --
           80
           72
           --
            80
            72
            --
             80
             72
             --
              8
             &c.
```

II. *Examples* having *Infinites* in the *Dividend.*

108348.936222, *&c.* given to be divided by 2.314, and 5.573573573 *, *&c.* by 24.

Here, becauſe the *Dividends* are *Infinites*, inſtead of annexing Cyphers for bringing out the *Quotient*, reiterate, or circulate as oft as there ſhall be Occaſion.

2.314)

2.314)108348.93622, &c. (46823.22, &c.
9256 2.314

15788 18729288
13844 46823222

19049 1404696666
18512 9364644444

108348.93622, &c. Proof.

5373
4628

7456
6942

5142
4628

5142
4628

514

24)5.573573 *, &c. (.* 232232 *, &c.
48 24

77 928928, &c.
72 4644644, &c.

53 5.573573 *, &c. Proof.
48

55
48

77
72

53
48

5

II. *Caſe*, is *Infinites* in both *Dividend* and *Diviſor*, or in the *Diviſor* only.

Rule. Having prepar'd the *Dividend*, by annexing Cyphers for the *Finite*, and by reiterating, or circulating for the *Infinite*, as before directed, reiterate or circulate the Diviſor in ſuch a Manner, as may caſt the laſt Figure of its Product below the firſt or ſecond Cypher annex'd, or Figure reiterated, and the laſt Figure, or ſo, of two *Circulates*; and, inſtead of bringing down from the Dividend, reiterate the laſt Figure of each remains, or circulate, if a *circulating Infinite*: Obſerving, all along, the Rules of *Multiplication* and *Subſtraction* as they occur.

1. *Example*. Having *Infinites* in the *Diviſor* only; as 436 given to be divided by .333, &c. and 28 by .6363, &c.

```
.3333)436.0000(1308        Diviſor,      .33, &c.
      333 3                Quotient,    1308
      -----                            -----
      10266                              266, &c.
      10000                            10000
      ------                           33333
       26666                           -----
       26666               Proof,      436.00
       -----
        ....

 .6363)28.000(44           Diviſor,      .6363
       25 454              Quotient,        44
       ------                           ------
        25454                            25454
        25454                           254545
        -----                           ------
        .....              Proof,      28.0000
```

II. *Examples* having *Infinites* in both *Dividend* and *Diviſor*. *Exempli cauſa*, Let 436.833, &c. be given to be divided by .66, &c. and 58448.039898, &c. by 4213.9898, &c.

.6666)

6666)436.833, &c. (655.25
40000

36833
33333

16666
13333

3333
3333

Diviſor, .66, &c.
Quotient, 655.25

333
1333
33333
333333
4000000

Proof, 436.8333, &c.

4213.9898989)58448.039898(13.87
42139898989

163081409090
126419696969

366617121212
337119191919

294979292929
294979292929

Diviſor, 4213.9898, &c.
Quotient, 13.87

294979292
3371191919
12641969696
42139898989

Proof, 58448.039898

Diviſion

Diviſion in Practice.

Queſt. 1. THe Sum of 770063 L. 13 ſh. 4 d. given to be divided equally among 25000 Men, what is each Man's Part?

```
25000)770063.666666(30.8025466, &c.
      75000 ......
      ------
       200636
       200000
       -------
          63666
          50000
          ------
          136666
          125000
          ------
           116666
           100000
           ------
            166666
            150000
            ------
             166666
             150000
             ------
              166666
              150000
              ------
               &c.
```

Queſt. 2. At 2 L. 6 ſh. 8 d. the 20 Ells, what is the Price of one Ell?

```
20)2.3333, &c. (.1166, &c.
    20
    ——
     33
     20
    ———
     133
     120
     ———
      133
      120
      ———
      &c.
```

Queſt. 3. If 8 Ounces of any Commodity coſt 10 d. what will be the Price of one Ounce thereof?

```
8).04166666(.00520833, &c.
   40....
   ———
    16
    16
   ————
    066
     64
    ———
      26
      24
     ———
       26
       24
      ———
        2
```

Queſt. 4. Suppoſe 21359.259259 *, &c. L. were given to be divided amongſt 264 Men, in ſuch Sort, that 263 are to be equal Sharers, and the one is to have a Third Part of an equal Share?

263.3333)21359.259259*, &c.(81.11, &c.
21066666

Equal Sharers 263.
$\frac{1}{3}$ Part Sharer ----.33,&c.

Diviſor, 263.33 *in inf.*

2925925
2633333

2925925
2633333

2925925
2633333

2925925
2633333

292592

Equal Sharers have each 81.11, &c.
$\frac{1}{3}$ Part Sharer 27.037037 *, &c.

Queſt. 5. 1030 L. and 15 ſh. to be divided amongſt 164, whereof 162 are equal Sharers, and one is to have Half an equal Share, and the other a Fourth Part Share, what muſt each have?

Equal Sharers are 162.
$\frac{1}{2}$ Sharer .5
$\frac{1}{4}$ Sharer .25

Diviſor, 162.75

162.75)10307500(6.33 *in infinitum.*
97650

54250
48825

54250
48825

5425
&c.

162 Men have each 6.33, &c.
$\frac{1}{2}$ Sharer has 3.1666, &c.
$\frac{1}{4}$ Sharer 1.5883, &c.

The following Queſtions anſwering to thoſe in *Multiplication*, are numbred with them, they being the Reverſe of them.

Queſt. 4. At 1.05 L. *Sterling* in one *Guinea*, how many *Guineas* in 168 L. *Sterling*?

1.05)168.00(160 *Guineas.*
105
630
630
00

Queſt. 5. At 12.6 L. *Scots* in a *Guinea*, how many *Guineas* in 2016 L. *Scots*?

12.6)2016.0(160 L. *Scots.*
126
756
756
0

Queſt. 6. In 95.94166, &c. L. *Scots*, how many *Rix Dollars*, at 2 L. 18 ſh. the *Rix Dollar*?

2.9)95.94166, &c.(33.0833, &c.
87 . . . .
89
87
241
232
96
87
96

Anſw. 33 *Dollars*, and .08333, *&c.* = a Half, a Third, and a Fourth Part.

Queſt. 7. At 1.5 Merk in a Pound *Sterling*, or L. *Scots*, how many Pounds in 75.5 Merks?

```
1.5)75.500(50.33, &c. L.
    75 ...
    ------
    050
     45
     ------
     050,
       &c.
```

Queſt. 8. At 4.5 Merks in a *Crown*, how many *Crowns* in 1560.375 Merks?

```
4.5)1560.375(346.75 Crowns.
    135....
    -----
     210
     180
     -----
      303
      270
      -----
       337
       315
       -----
       0225
        225
```

Follows the 9th and 10th of *Multiplication*, done by *Diviſion*.

Queſt. 9. At 1.5 in the Merk, how many L. *Sterling*, or *Scots*, in 1512.5 Merks?

1.5)

```
1.5)1512.500(1008.33, &c. L. Sterl. or Scots,
    125
    ---
     50
     ---
      50
     ---
       5
      &c.
```

Queſt. 10. In 20713½ Merks *Scots*, how many L. *Sterl* at 18 Merks in a Pound?

```
18)20713.50(1150.75 L. Sterling.
   18 ... ..
   --
    27
    18
    --
     91
     90
    ---
     135
     126
     ---
       90
       90
```

Here, the *Quotients* are the ſame with the *Products* in *Multiplication*.

⁂

THE

THE GOLDEN RULE, OR, *Rule of* THREE, OR, *Rule of* PROPORTION.

And Firſt, Of the Single Rule of THREE DIRECT.

IN this *Rule* there are three Numbers given to find out a Fourth, which Numbers muſt be ſo ranked or ſtated, that Two having like Signs or Characters, muſt be ſeparated by One of a different Denomination or Name.

Then, for the Work, multiply the ſecond and third Terms together, and having divided that *Product* by the Firſt, the *Quotient* is the Anſwer to the Queſtion, and is the fourth Number ſought.

Example 1. If 24 Ells of Cloth coſt 198 L. 6 ſh. what will 335 Ells and an Half coſt?

```
Ells.  L.    Ells.
24—198.3—335.5
          198.3
          -----
          10065
         26840
        30195
        3355
        -------------
        24)66529.65000(2772.06875 L. 4th Term.
```

Anſw. 2772 L. and .06875, which is 1 ſh. 4½ d. juſt.

Example 2. At the Rate of 300 L. 8 ſh. 8 d. the 18 Bolls, 3 Firlots of Barley, what is the Price of 84 Bolls, 1 Firlot, 2 Pecks ?

18.75---300.433, &c. ---- 84.375

84.375

1502166

21030333

901300

1201733333

24034666666

18.75)25349.062500(1351.95 L.

1875

6599

5625

9740

9375

3656

1875

17812

16875

9375

9375

0

1351 L. 19 ſh. for Anſwer.

Queſt. 3. If a Staff, or Pole, 6 Foot 4 Inches, ſet upright, caſt a Shadow 8 Foot 8 Inches long, and at the ſame Time, a Tower or Houſe caſt a Shadow of 520 Foot 11 Inches, and .44 of an Inch ; which .44 of an Inch may be reduced to the Decimal of a Foot, thus, ſeeing there are 12 Inches in a Foot, it will then be .44 of $\frac{1}{12}$, or Vulgar ways, $\frac{44}{100}$ of $\frac{1}{12}$, = the *ſingle Fraction* $\frac{44}{1200}$ = .0366, *&c.* And this added to the Decimal, for 11 Inches being .9166, *&c. facit* .9533, *&c.* the Decimal for 11.44 Inches.

As 8.66, *&c.*——6.33, *&c.*——520.9533, *&c.*
6.33, *&c.*

$\frac{1}{3}$ = 1736511
31257200

8.66666)3299.3711, *&c.*(380.6966, *&c.*
2600000

6993711
6933333

6037777
5200000

8377777
7800000

5777777
5200000

577777

Queſt. 4. If $3\frac{1}{2}$ Ells *Scots* be equal to 5 *Flemiſh*, how many *Scots* Ells in 140 *Flemiſh* ?

As 5——3.5——140
3.5

700
420

5)490.0(98 *Scots* Ells in 140 *Flemiſh*.

40

0

Queſt. 5. A Merchant buys at *Burdeaux* 100 Tuns of Wine for 430 L. *Sterling*, 18 ſh. 10 d. He paid for Freight 200 L. 9 ſh. 8 d. for Loading and Unloading 20 L. 4 ſh. and 4 d. for Cuſtom 52 L. each Tun; for Cellar Rent, and other Incidents, 20 L. 5 ſh. and 10 d. He deſigns to ſell the Wine at ſuch a Rate, as to gain 300 L. of Profit upon the Bargain. A Vintner offers to buy 35 Tuns: The Queſtion is, what he muſt get for the 35 Tuns, ſo as to anſwer his Deſign of Profit?

Prime Coſt,	430.94166
Freight,	200.48333
Loading and Unloading,	20.21666
Cuſtom, 52 L. each Tun,	5200.
Cellar Rent, and other Incidents,	20.29166
Profit	300.
	6171.93333

100 —— 6171.933, &c. —— 35

35

3703 1600

308596666

---

100)3456.28266166, &c.(3456.28266, &c.

Anſw. The Merchant, to anſwer his deſign'd Profit, muſt ſell the 35 Tuns at 3456.28266, &c.

Queſt. 6. A certain Gentleman being on his Death-bed, made his *Will*, whereby he diſpos'd of his whole Eſtate, which he valued at 50000 L.. between his two Sons, as follows: To the Eldeſt 30000 L. to the Second 20000 L. but when the Gentleman was deceaſt, his Fortune was found to be only worth 40400 19 s. 10 d. L. The Queſtion is, what each Son muſt have thereof?

50000 —— 30000 —— 40400.99166, &c.

40400.99166, &c.

30000

50000)1212029750.00000(24240.595

50000

50000 —— 20000 —— 40400.99166, &c.

40400.99166, &c.
20000
50000)808019833.333, &c.(16160.3966, &c.

Eldeſt Son's Proportion	24240.595
Second Son's	16160.39666
Proof	40400.99166, &c.

Queſt. 7. A certain Father being ſick, made his *Will*, and died, leaving his Wife big with Child; and, in his *Will*, ordain'd, That if ſhe had a Daughter, the Mother ſhould have $\frac{2}{3}$ Parts of his Eſtate, which was 24000, and the Daughter $\frac{1}{3}$ Part; but if ſhe had a Son, then he ſhould have $\frac{2}{3}$ Parts, and the Mother $\frac{1}{3}$ Part. Now it happened that ſhe was both delivered of a Son and a Daughter: The Queſtion is, what Part of the Eſtate each of them muſt have, ſo as the *Teſtator's Will* may be obeyed?

It is obvious that the Teſtator's Mind and Will was, That the Mother ſhould have twice as much as the Daughter, and the Son twice as much as the Mother: So that if the Daughter have 2 L. the Mother muſt have 4, and the Son 8; therefore add theſe 3 Numbers together, 2, 4, 8. and they make 14; then ſay,

As 14 is to 2, ſo is 24000 to the Daughter's Share.
As 14 is to 4, ſo is 24000 to the Mother's.
And as 14 is to 8, ſo is 24000 to the Son's.

Or, it may be wrought as the former Example, thus, The Daughter is to have $\frac{1}{3}$ of the Eſtate, which will make 8000 L. and the Mother the Double, is 16000; and the Son Double the Mother, *viz.* 32000: Theſe Three added together, make in all 56000: Then ſay, by the *Rule of Three*,

If 56000 give 8000 to the Daughter, what will 24000, the real Eſtate, give?

If 56000 give 16000 to the Mother, what will 24000 give?

If 56000 give 32000 to the Son, what will 24000 give?

But, in laying on a *publick Stent* or *Ceſs* upon a *Pariſh* or *Shire*, where many Perſons are concerned, *Decimal Arithmetick* furniſhes us with a more compendious Way, whereby, inſtead of many *Multiplications* and *Diviſions* for finding out the *Heritors* ſeveral Shares of the *Stent* or *Burden*, we may, after having found what 100, 1000, or ſo, pays, by ſhifting the Decimal Sepatrix backward or forward, diſcover what 1, 2, 3, 80, 246, or any other Sum whatſoever, is to pay of the ſaid *Stent* or *Burden*.

Or rather, for Brevity's ſake, and what I intend to follow, is, firſt find out what 1 L. will pay of the Stent, and having multiplied each Heritor's valued Rent thereby, the ſeveral Products are the Anſwers.

Example. There are in a Pariſh three Heritors, *A*, *B*, and *C*. *A*'s valued Rent is 5333 L. 6 ſh. 8 d. *B*'s, 2144 L. 3 ſh. 4 d. and *C*'s, 986 L. and 10 d. Now, ſuppoſe there was a Stent of 5275.6076388, *&c.* laid upon the Pariſh, to be paid by the Heritors proportionally to their valued Rents: The Queſtion is, what will each Heritor's Proportion of the ſaid Stent or Burden be?

A's valued Rent,	5333.33333
B's,	2144.16666
C's,	986.04166
	8463.54166, *&c.*

If 8463.54166, *&c.* —— 5275.6076388, *&c.* —— 1

8463.541666, *&c.*)5275.6076388, *&c.* (.6233, *&c.*

5078 1250000

19748263888

16927083333

28211805555

25390625000

28211805555

&c.

5333.33, *&c.*	2144.166, *&c.*	986.04166, *&c.*
.6233, *&c.*	.6233, *&c.*	.6233, *&c.*
$\frac{1}{3}$= 177777	$\frac{1}{3}$=0714722	$\frac{1}{3}$=32868055
1066666	4288333	197208333
32000000	128650000	5916250000
3324.4444, *&c.*	1336.53055, *&c.*	614.6326388, *&c.*

A's Part,	3324.4444444, *&c.*
B's Part,	1336.5305555, *&c.*
C's Part,	614.6326388, *&c.*
Proof	5275.6076388, *&c.*

The Single Rule of THREE INDIRECT.

THis *Rule* differs only from the former *Rule Direct*, in that here, you multiply the *Firſt* and *Second Terms* together, and having divided that Product by the *Third Term*, the Quotient is the Anſwer, or *Fourth Term* ſought.

Example. If, when the Boll of Wheat is 6 L. 5 ſh. the Half-penny Loaf ought to weigh 8 Ounces 8 Drops, what ought the Half-penny Loaf to weigh when the Wheat is 11 L. 6 ſh. 8 d.?

6.25 —— 8.5 —— 11.3333, *&c.*)53.1250(4.6875

8.5	45.3333
3125	779166
5000	680000
53.125	991666
	906666
	850000
	793333
	566666
	566666
	......

To know whether any Queſtion propoſed belong to *this*, or the *former Rule*, look upon the *firſt* and *third Terms* as two Extremes; and if more is required, the leſſer Extreme is the Diviſor, and if leſs, the greater Extreme is the Diviſor.

Example 2. If I ſhould lend my Friend $\frac{1}{2}$ Guinea for Half a Year, upon Condition that he ſhould do the like by me; but when I came to borrow of him, he could lend me only $\frac{1}{3}$ Guinea; The Queſtion is, how long I muſt keep the ſame in Requital of my Loan?

```
.5 —— .5 —— .33, &c. ).250(.75
.5                     233
——                     ———
.25                    166
                       166
```

Example 3. How much of 4 Quarters and Half Quarter broad Sarge, will ſerve to line 15$\frac{1}{2}$ Ells, 6 Quarters broad?

```
Qrs.    Ells.    Qrs.    Ells.
 6 ——   15.5 ——  4.5)93.0(20.66, &c.
          6         90
        ————        ———
        93.0        300
                    270
                    ———
                     300
                     270
                     ———
                      300
                      270
                      ———
                       30
                       &c.
```

Example 4. A Caſtle being beſieged, and having in Garriſon 260 Men, and 30 Days Proviſion only: The Queſtion is, how many Men muſt be ſent out, that their Proviſion may ſerve them 130 Days?

30

30 —— 260 —— 1310)78010(60
30   78
—— ——
7800   00

Anſw. They muſt keep 60 Men, and conſequently diſmiſs 200 Men.

The Double GOLDEN RULE DIRECT.

IN this *Rule*, there are Five Numbers given to find out a Sixth; Which Numbers muſt be ſo ſtated or ranked, as that the Firſt and Fourth, the Second and Fifth, the Third and Sixth, or Number ſought, be of the ſame Denomination or Name.

Then for the Work.

Having multiplied the three laſt Terms together, and divided that by the Product of the firſt and ſecond Term, the Quotient is the Anſwer, or ſixth Term ſought.

Example 1. If 3 Maſons build $32\frac{1}{2}$ Roods of Wall in 8 Days, how many Roods will 7 Maſons build in 31 Days?

Maſ. Days. Roods. Maſ. Days.
3 —— 8 —— 32.5 —— 7 —— 31
8   7
—   ——
24 Diviſ.   217
32.5
——
1085
434
651
——
7052.5   24)

24)7052.5(293.854166, &c. Roods for Anſwer,
48

225
216

92
72

205
192

130
120

100
96

40
24

160, &c.

Example 2. If the Sum of 666 L. 13 ſh. 4 d. being improven in Merchandice, ſhall, in 3 Years, ariſe to 664 L. 10 d. what will 888 L. 6 ſh. 8 d. ariſe to in 16 Years, being improven at the ſame Rate?

L.	Years.	Increaſe.	L.	Years.
666.66 ——	3 ——	664.04166, &c. ——	888.33 ——	16

666.66
3

2000.00

664.04166, &c.
888.33, &c.

$\frac{1}{3}$ = 22134722
531233133
5312331333
53123313333

589890.12522, &c.
16

353934075133
589890125222

6000)9438242.003551555, &c.(4719121.00177, &c.

Anſw. 888 L. 6 ſh. and 8 d. will amount to, being improven in Merchandice 16 Years, 4719121 L. 1.7066, &c. Farthing.

Example 3. If the Carriage of 200 Weight of Wool, for 50 Miles, coſt 2 L. 4 ſh. 1 d. what will 1000 *C.* Weight coſt for 100 Miles Carriage?

*C.*Wt. Miles. L. *C.*Wt. Miles.
200 —— 50 —— 2.204166, &c. —— 1000 —— 100
50 1000
10000 2204.166666
100
10000)220416.6666, &c. (22.041666, &c.

Double GOLDEN RULE INDIRECT.

THis *Rule* differs only from the former in the Method of Working: For here you multiply the three middle Terms together, and having divided that by the Product of the firſt and fifth Term, the Quotient is the Anſwer.

Example. If the General of an Army ſhould ſet 400 Men a-work, which, in 12 Hours, did caſt a Trench of 300 Ells, I demand how many Men it would require to caſt a Trench of 6000 Ells in 18 Hours?

300 —— 12 —— 400 —— 6000 —— 18
400 300
4800 5400
6000
28800000

5400)

M.
5400)28800000(5333.333, &c.
27000 . . .

18000
16200

18000
16200

18000

Anſw. 5333 Men, and $\frac{1}{3}$, *i. e.* the third Part of on
Man's Work.

All Queſtions in the *Double Golden Rule*, *Direct* or *Indirect*, may be wrought at 2 ſingle Operations, thus, Take the laſt Example of the former Rule, and ſay, If the Carriag of 200 *C.* Weight of Wool coſt 2 L. 4 ſh. 1 d. what wil 1000 *C.* Weight coſt?

200 —— 2.204166, &c. —— 1000
1000

L.
2|00)2204.16|66, &c. (11.020833, &c.

Again, ſay, If 50 Miles coſt 11.020833, &c. L. what wil 100 Miles coſt?

50 —— 11.020833, &c. —— 100
100

L.
5|0)1102.08333|3, &c. (22.04166, &c.

Anſw. 22.04166 L. as before.

Again, take the Example of this Rule, and ſay, If Trench of 300 Ells require 400 Men, how many Men wil a Trench of 6000 Ells require?

300 —— 400 —— 6000
6000

3|00)24000|00(8000

Again, If 12 Hours require 8000 Men, how many Men will 18 Hours require?

12 —— 8000 —— 18
8000

18)96000(5333·33, *&c.* *Anſwer* as before
90
60
54
60
60

The Rule of Fellowſhip, *or* Copartnerſhip.

THis *Rule* principally concerns two or moe Perſons, who, trading together, do, of their ſeveral Stocks, make up one common Stock, and divide the Gain or Loſs amongſt them, in Proportion to their particular Stocks, or what each hath therein. And it is either *without*, or *with Time*.

Fellowſhip without Time is tied to this Proportion.

As the whole Stock
Is to the whole Gain or Loſs;
So is each Man's particular Stock
To his particular Share.

Fellowſhip with Time is wrought thus:

Multiply each Man's Money, or Effects, ſeverally, by his Time, and having added their Products together, that *Total* is the unalterable *firſt Term* in the *Rule of Three*.

The Gain or Loſs is always the *ſecond Term.*

And the ſeveral Products, one after another, the *third Term.*

Queſt. 1. *Without Time. A.* and *B.* buy a Parcel of Goods, for which *A.* laid out 8 L. and *B.* laid out 13 L. and having ſold the ſaid Goods, they find they had gained 2 L. 16 ſh. The Queſtion is, How much thereof belongs to *A.* and how much to *B.*?

A. had in Stock 8
B. 13

As 21 —— 2.8 —— 8
8
21)22.400(1.066, &c.
21
140
126
140
&c.

As 21 —— 2.8 —— 13
13
84
28
21)36.4(1.73, &c.
21
154
147
70
63
70
&c.

A's Part of the Gain 1.066, &c.
B's 1.733, &c.
2.800

Queſt. 2. *Without Time.* Suppoſe Four Merchants, *A*, *B*, *C*, and *D*, buy amongſt them 1500 Pound of *Spiceries*, for which they pay 900 L. and of which 1500 Pound Wt. *A* gets 430 Pound, *B* 380 Pound, *C* 399 Pound, and *D* 291 Pound Weight. The Queſtion is, What Part of the 900 L. each of them muſt pay; what every Ounce ſtands them, and how they may ſell the Ounce, ſo as to gain 12 ſh. upon each Pound Weight, and what the whole Gain will be? And Laſtly, What each Man's particular Gain will be?

Firſt, For their Parts of the 900 L. ſay,
As 1500 Pound Weight are to 900, ſo is 430 to *A*'s Part of the 900 L.
As 1500 to 900, ſo 380 to *B*'s Part.
As 1500 to 900, ſo 399 to *C*'s Part.
As 1500 to 900, ſo 291 to *D*'s Part.

A.

1500 —— 900 —— 430
900

1500)387000(258 L. *A*'s Part of the 900 L.

B.

1500 —— 900 —— 380
900

1500)342000(228 *B*'s Part.

C.

1500 —— 900 —— 399
900

1500)359100.00(239.40 *C*'s Part.

D.

1500 —— 900 —— 291
900

1500)261900.0(174.6 *D*'s Part.

Firſt Anſwer.

A. muſt pay of the 900 L.	258.
B.	228.
C.	239.4
D.	174.6
	900.

2dly. For what the Ounce ſtands them.

Pounds. L. Pounds.
If 1500 —— 900 —— 0625
900

1500)56.2500(.0375 Oun. coſt
16

Pound coſt .6000
.6

So as to anſwer the deſir'd Gain,
the Pound muſt be ſold at 1.2 *Anſw.* 2.

And if the Pound be ſold at 1.2, what muſt the Ounce be ſold at?

Pounds. L. Pounds.
If 1 —— 1.2 —— .0625
1.2

1250
625

The Ounce, to anſwer the
deſired Gain, muſt be ſold at .07500 *Anſw.* 3d.

If one Ounce coſt .075, what will be gotten for the whole 1500 Pound Weight?

.0625 —— .075 —— 1500
.075

7500
10500

.0625)112.500(1800 Price ſold.
900 Price bought.

900 Gain.

Here, as it has fallen out that the whole Gain is the ſame with the Total, or prime Coſt, *viz.* 900 L. each, it is plain that their particular Profit will be one and the ſame with their particular Payments in the firſt Anſwer.

Example 1. *With Time.* Two Merchants, *A*, and *B.* accompanying together for a Time, had one common Stock, wherein *A* had 800 L. 10 d. for Two Months, *B* 711 L. 2 ſh. and $\frac{4}{9}$ of a Pence for Nine Months; at Parting, they find they had gained 512 L. what is each Man's Part of the Gain?

A had in Stock 800.04166, &c.
Multiplied by his Time, 2 Months,
Product is 1600.08333333

B had in Stock 711.10165185
Multiplied by his Time, 9 Months,
Product is 6399.9166666

8000.000

8000 —— 512 —— 1600.0833, &c.
512

32001666
160008333
8000416666

8|000)819242.6666(102.40533, &c.

8000 —— 512 —— 6399.9166, &c.
512

127998333
639991666
3199958333

8|000)3276757.3333(409.59466, &c.

A's Part of the Gain	102.40533
B's	409.59466
	512.00000

Example 2. *With Time.* Three Merchants, *A*, *B*, and *C*, make up a Joint-ſtock, with which they trade for 18 Months. At the Beginning *A* puts in 90 L. and 9 Months after takes out the 90 L. and 6 Months after that, puts in 1156.1077407407 *, &c.

B puts in at firſt 153 L. 4 d. and 7 Months after he puts in 20 L. 2 ſh. 7 d. and after 8 Months takes out 36 L.

C puts in at firſt 241 L. 12 ſh. 9 d. 1 f. and after 3 Months takes out 52 L. 8 d. and $3\frac{1}{2}$ Months after takes out 52 L. 1 ſh. 5 d. more, and $2\frac{1}{4}$ Months after, returns to the Stock 63 L. 2 ſh. $2\frac{2}{3}$ d.

Now, at the End of the 18 Months, they find they had gained 578 L. 6 ſh. 8 d. what is each Man's particular Gain?

A had 90, Products. Totals.
for Months 9
————---810.

A, after having taken out the 90 L. for 6 Months, puts in 1156.1077407407 *
for Months - - - 3
————3468.323222, &c.
———— ————-4278.323222, &c.

B had 153.0166, &c.
for Months - 7
————1071.116666

B putting in 20.129166 L. more, had then in Stock 173.145833, &c.
for Months - 8
————1285.166666

Having taken out 36 L. had then in Stock 137.145833
for Months - - 3
————411.4375
———— ————---2767.7208333, &c.

C had

	Products.	Totals.
C. had 241.63854166, &c. for Months - 3	724.915625	
Having taken out 52..033, &c. had then in Stock 189.60520833, &c. for Months - 3.5	63.617229166	
Again, taking out 52.0708333, &c. had then in Stock 137.534375 for Months - 2.25	309.45234375	
Having return'd to the Stock 63.111, &c. had then in Stock 200.64548611, &c. for Months 9.25	1855.9707465277	2953.955944, &c.
Sum of the Totals		10000.

10000 —— 4278.32322, &c. —— 578.33, &c.
578.33

$\frac{1}{3}$ = 142610774074074 *
342265857777777
2994826255555555
21391616111111111
10000)2474296.93018518518(247.4296930185185, &c.

10000 —— 2767.720833, &c. —— 578.33, &c.
578.33

$\frac{1}{3}$ = 0922573611
22141766666
193740458333
1383860416666
10000)1600665.215277(160.0665215277, &c.

```
10000 —— 2953.955944, &c. —— 578.33, &c.
                   578.33
            ——————————————
          ⅓ = 098465198148148 *
               236316475555555
              2067769161111111
             14769779722222222
             ——————————————————
10000)1708371.1878703703 7(170.83711878703703 70
```

A's Part of the Gain	247.42969301851 85 *, &c.
B's	160.066521527777 7, &c.
C's	170.83711878703 70
Total Gain	578.33333333333333

INTEREST:

OR,

ANNUALRENT of Money, for any Number of Years, Months, and Days, at any *Rate* and *Retention*, by a Hundred *Pound* Principal *per Annum.*

INTEREST is either *Simple* or *Compound.*

Simple Intereſt is only ſo much as the *Law* directs for each Hundred of Principal *per Annum.*

And by this Proportion,

As a Hundred Pound Principal
Is to the current Annualrent;
So is the given Principal
To the Intereſt required.

Example. What is the Intereſt of 782 L. 13 ſh. 4 d. for one Year, at 5 L. for the 100 L.?

100 —— 5 —— 782.66, &c.

5

100)3913.33(39.133, &c.

20

ſh. 2.666

12

1333

6666

d. 8.000

Anſw. 39 L. 2 ſh. 8 d. juſt.

But the moſt compendious Way of computing Intereſt is as follows. Having multiplied the Principal by the current Annualrent, cut off from the Product two Places more for Decimals than you have in Multiplicand and Multiplier; which is the ſame as if you divided by 100.

Example. At 5 L. the 100 L. *per Annum*, what will 445 L. 5 ſh. 2 d. give?

445.25833, &c.

5

22.2629166 = 22 L. 5 ſh. $3\frac{1}{10}$ d. juſt.

And thus having the Annualrent of any Principal for a Year, that multiplied by any Number of Years, gives the Intereſt thereof for the Time requir'd.

For Inſtance, the Intereſt of 445 L. 5 ſh. and 2 d. for one Year, being 22.2629166, &c for two Years, it will be Double, for three Years the Treple, &c. of 22.2629166.

Again, if by the Intereſt of 100 L. *per Annum*, you would know the Intereſt of 100 L. for one or more Months, The Proportion is,

As 12, the Months in one Year,
Is to the Intereſt of 100 L.;
So is the Number of Months given,
To the Intereſt requir'd.

Example. At 5 L. the 100. for one Year, or 12 Months, what will 1 Month give?

As 12 —— 5 —— 1
1

———

12)5.0000(.4166, *&c.*

Anſw. .4166, *&c.* is the Intereſt of 100 L. for 1 Month, and ſo on to any Number of Months, multiplying .4166, *&c.* thereby.

Laſtly. By the Intereſt of 100 L. for one Year, you may diſcover its Intereſt for any Number of Days, by this Proportion.

As 365, the Days in one Year,
Is to the Intereſt of 100 L. Principal;
So is the Days demanded,
To the Intereſt required.

Example. At 5 L. the 100 L. for one Year, or 365 Days, what will one Day give?

365 —— 5 —— 1
1

———

365)5.0000(.0137 *fere.*

Anſw. .0137 is the Intereſt of 100 L. for one Day, by admitting of 5 Hours and 49 Minutes, which, together with 365 Days, make up a Solar.

And thus, having 5 L. for the Intereſt of 100 L. for one Year, .4166, *&c.* for 100 L. for one Month, and .0137 the Intereſt of 100 L. for one Day, theſe multiplied ſeparately by any Number of Years, Months and Days, and any Principal multiplied by the Total of their Products, gives the Intereſt of that Principal for the Time requir'd.

Example. At 5 L. the 100, what will 8640 L. 14 ſh. 4 d. give for 16 Years, 6 Months, and 3 Days?

5 L. Intereſt for 16 Years, is	80.
.4166, &c. for 6 Months, is	02.5
.0137 for 3 Days, is	00.0411
	82.5411

Principal 8640.7166, &c.
82.5411

86407166
864071666
34562866666
432035833333
1728143333333
69125733333333

7132.1425845500

Anſw. L. 7132.14258455, when two more than the Fraction are cut off.

Albeit the former Examples only relate to 5 L. the Intereſt of 100 L. Principal for one Year, as by Act of Parliament; yet, in the foregoing Proportions, by putting any other Intereſt in the Room of 5, as ſuppoſe 5.5 or 6. Thus the Intereſt of 100 L. at 5.5 for 1 Year, 1 Month, and 1 Day, will be,

5.5 L. for one Year,
.45833, &c. for one Month,
.015068 for one Day.

Example. At 5 L. 10 ſh. *per Cent.* what will 12200 L. 8 ſh. 8 d. give for 40 Years, 10 Months, 15 Days?

5.5 Intereſt for 40 Years, is	220.
.45833, &c. for 10 Months, is	004.5833, &c.
.015068 for 15 Days, is	.22600
Totals added,	224.80933, &c.

224.80933, *&c.*
12200.433, *&c.*

$\frac{1}{3}$ = 7493644
89923733
449618666666
4496186666666
22480933333333

27427.71284044

Anſw. 27427 L. 14 ſh. 3.0817066, *&c.* d.

And at 6 *per Cent. per Annum*, the Rates are,
6 L. Intereſt for one Year,
.5 for one Month,
.0164383 for one Day.
Which you may uſe as before directed.

COMPOUND INTEREST: *or*, Intereſt *upon* Intereſt.

COMPOUND INTEREST is, when Intereſt is not punctually paid up, and ſo comes to bear Intereſt together with the Principal.

Wherefore, to know the Amount of any Principal, for any certain Term, accounting at the Rate of *Compound Intereſt*, the *Rule* will be,

As any Principal, or Sum,
Is to its Amount;
So is any other Principal, or Sum,
To its Amount, for the ſame Term of Time.

For *Example*, At 5 *per Cent*. the *Ratio* will be, As 100 L. Principal is to 105 L. Principal and Intereſt; ſo is any other Sum to its Principal and Intereſt for the ſame.

Example 1. What is the Intereſt of 30 L. for two Years, accounting at the Rate of 5 *per Cent. per Annum*, Compound Intereſt?

Prin Pr. & Int. Pr.
If 100 —— 105 —— 30
30
———— L.
1|00)31|50(31.5 Firſt Year's Amount.
100 —— 105 —— 31.5
105
————
1575
315
———— L.
1|00)330|75(330.75 Second Year's.

But becauſe dividing by 100 is equal to cutting off the two laſt Figures in the Dividend, the Work may ſtand as below.

Example 2. What is the Intereſt of 466 L. 8. ſh. 10$\frac{2}{3}$ d. at 5 *per Cent.* for 3 Years?

466.44, &c.
105
————
233222
4664444
————
489.7666 Firſt Year's Amount.
105
————
2448833
48976666
————
514.25500 Second Year's.
105
————
2571275
514255
————
539.96775 Third Year's.

At 5 L. 10 ſh. *per Cent. per Annum*, what is the Intereſt of 212 L. 6 ſh. 8 d. for two Years?

```
        212.33, &c.
         105.5
       ---------
         105166
        1051666
       21233333
       ---------
      223.90166, &c. First Year's Amount.
         105.5
       ---------
       111950833
      1119508333
     22390166666
     -----------
     236.21625833, &c. Second Year's.
```

Extraction of the Square Root.

A SQUARE, in *Geometry*, is a ſuperficial Figure of Four equal Sides, any one of which is called the *Root*: And a *Square Number* is what the *Square* contains in any Meaſure, found by multiplying the *Root*, or *Side*, into itſelf.

Extraction of the Square Root is, finding the Side of any Figure whoſe Multiplication will equal the *Square Number*, or, come neareſt to the Contents of the Square given. As, ſuppoſe the *Square Number* to be 36 Poles, Ells, Feet, or Inches, the *Root* thereof is 6, for 6 Times 6 is 36, and ſo of any other.

Square Numbers are either *Simple* or *Compound*.

Simple Square Numbers do not exceed 81, nor their Roots reach any further than ſome one of the Nine Digits, as follows.

Simple Square Numbers,	1,	4,	9,	16,	25,	36,	49,	64,	81.
Simple Square Roots,	1,	2,	3,	4,	5,	6,	7,	8,	9.

Explanation. You have here under each particular Square Number, the ſeveral Roots peculiar to thoſe Numbers; as 2 under 4; and 3 under 9, *&c.* and for every one other that is not an exact Square, take the neareſt leſs Root thereto, as the Root 4 from 16 to 24, and 5 from 25 to 35, *incluſive, &c.*

Compound Square Numbers are begun with 100; and carried on to what Length you pleaſe, as are alſo their Roots from 10, found out by the following Directions.

GENERAL RULE,

For extracting the Square Root of any compound Square Number.

Having a Square Number given, you muſt firſt diſtinguiſh it into ſingle Squares, by beginning at the right Hand Figure or Cypher, and placing a Point over every other Figure; *i. e.* point one, and paſs another: And ſo many Points as you have, as many Places will the Root conſiſt of. Then for the Work.

Having drawn a crooked Line on the Right, as in *Diviſion*, ſeek the neareſt Root of the firſt ſingle ſquare Number or Point, and having plac'd it in the Quotient, and its ſquare Number below the Places of the firſt Point, ſubſtract, and to the Remainder bring down the next ſingle Square or Point; and for the other Places of the Root, obſerve this *general Direction.*

Having drawn a crooked Line to the Left of the Remains and Point brought down, called the *Reſolvend*, place to the Left of it the Double of the Quotient, in Form of a *Diviſor*; and having divided all but the Unites Place thereby, ſet the neareſt Number found, both in the Quotient, and to the Right of the Diviſor, at the ſame Time; and having multiplied the *Diviſor* by the Figure laſt found, and ſubſtracted that Product from the Remains, *&c.* or *Reſolvend*, bring down the next ſingle Square, or Point, and renew the Operation till all your Points are employ'd or accounted for.

Example. What is the Square Root of the Square Number 291669124096?

```
· · · · · ·
291669124096(540064
25
104)416
    416
108006)0691240
        648036
1080124)4320496
        4320496
·······
```

If the Number propos'd be not an exact ſquare Number, ſo that after the Points are brought down and wrought, there is ſtill a Remains, then, for a *finite Fraction*, add Pairs of Cyphers at Pleaſure, and as many Pairs of Decimals as there are, ſo many point off for Decimals in the *Root*, or *Quotient*; but if it be an *Infinite*, reiterate or circulate the ſame, inſtead of annexing Cyphers. And for the Proof, if the *Root*, multiplied into itſelf, produce the *Square Number*, the Work is right, and where there is Remains they muſt be taken into the Product. This laſt is not to be underſtood where an *Infinite* occurs.

Example 1. Of a *Finite.* What is the Square Root of 50288.062 ?

. . . . . .
50288.062000(224.249 Root, or Side.
4
42)102
84
444)1888
1776
4482)11206
8964
44844)224220
179376
448489)4484400
4036401
447999 Remains.

Proof 224.249
224.249
2018241
896996
448498
896996
448498
448498
50287.614001
447999 Remains added.
50288.062

Example 2. Of an *Infinite.* Let 1174.20444, &c. be given to extract its *Square Root.*

1174.204444, &c. (34.2666666, &c.
9

64)274
256

682)1820
1364

6846)45644
41076

68526)456844
411156

685326)4568844
4111956

6853326)45688844
41119956

68533326)456888844
411199956

685333326)4568888844
4111999956

456888888
& *ſic ad infinitum,*

Proof 34.266
34.266

$\frac{1}{3}$ 11422
11422
68533
1370666
10280000

1174.2044, &c.

Uſe

Uſe of the Square Root *in Military Affairs.*

SUppoſe an interveening Ditch, 7 Ells broad, betwixt and the Wall of a Fort 24 Ells high; of what Length ſhall a ſcaling Ladder be to reach from the Brink of the Ditch to the Top of the Wall?

Square the Height of the Wall and Ditch ſeverally, which together make 625 Ells, the Root whereof is 25, for the Length of the Ladder requir'd.

Wall's Height	24	Breadth of the Ditch	7
	24		7
	96	Ditch's Square	49
	48		
Wall's Square	576		

Wall's Square 576
Ditch's Square 49

Sum of the Squares 625(25 Length of the Ladder.
4
45)225
225

Example 2. Suppoſe 4096 Soldiers to be drawn up in a ſquare Battle, what Number muſt there be in Rank and File?

The Root of 4096 is 64, and ſo many muſt there be in each.

4096(64
36
124)496
496
0

Example 3. Suppoſe 322944 Soldiers to be drawn up in the Form of a *long Square*, with this Proportion, That the Number in File be to the Number in Rank, as 2 is to 3, or *vice verſa*, the Number in Rank to the Number in File, as 3 is to 2, how many muſt there be in each?

Having wrought by the two Proportions, and extracted their Roots, you have for Anſwer, 696 in Rank, and 464 in File.

```
First Proportion.  As 2 —— 3 —— 322944
                                     3
                               ———————
                              2)968832(484416

            484416(696 in Rank.
            36
           ————
        129)1244
            1161
           —————
             8316
             8316
             ————
                0
```

```
Second Proportion.  As 3 —— 2 —— 322944
                                      2
                                 ———————
                               3)645888(215296

            215296(464 in File.
            16
           ————
         86)552
            516
           —————
        924)3696
            3696
           —————
              0
```

Or, when any of the Numbers is ſound, whether Rank or File, the Number of Soldiers divided thereby, gives you the other.

```
696)322944(464 in File.
     2784
     ————
      4454
      4176
      ————
       2784
       2784
       ————
```

Practice, or Uſe of the Square Root *in Menſuration.*

Queſt. 1. A *Square* being a Figure of equal Sides, what is the neareſt *Root* to 160, the *Falls* or *Poles* in one *Acre?*

This is one of thoſe which is not an exact *ſquare Number*, and in ſuch Caſes of *Practice* it is neceſſary to give the *Decimal Seconds* ſome ſmall Allowance, conſidering that the greateſt Diviſion on the *Chain* or *Line* does not exceed two Places of Fraction: So, by this Rule, the neareſt Root or Side to 160, is 12.65, and that ſquar'd, or multiplied into itſelf, and the Product thereof divided by 160, is little more than one Acre.

```
      .  .  .  .
     160.0000(12 65 fere.
      1                 12.65
     ———                12.65
  22)060               ——————
     44                 6325
    ————                7590
 246)1600              2530
     1476             1265
    —————            ———————
 252)12400    160)160.0225(1.001
```

To lay down a right Square any Number of Times, greater or leſſer than a given Square,

Square the Side of the given Square, and when more is required, *multiply*, when leſs, *divide* by the Number of Times, and the Root of the laſt Product or Quotient anſwers the Demand.

Queſt. 2. Ten Acres, or 16 Falls or Poles, being 40 on a Side, what is the Root or Side of one four Times greater than the Square given?

40
40
Square 1600
4
6400

6400(80 the Root or Side.
64
000

Anſwer. 80 Falls or Poles is the Root or Side of a Square containing Four Times the given Square; which 80 ſquar'd and divided by 160, is 40 Acres; and 40 Falls or Poles, the Side of the given Square, is only found to contain 10 Acres, as below.

80
80
160)6400(40 Acres.

40
40
160)1600(10 Acres.

Queſt. 3. There is a ſquare Garden 2486 Poles or Falls every Way, what muſt the Side of one be that ſhall contain the $\frac{1}{4}$ thereof?

Having divided 6180196, the Square of 2486 for the 4th Part leſs, and extracted the Root of the Quotient, *viz.* 1545049, the Root is 1243, which is the Side of a Square Four Times contain'd in the former.

2486
2486

14916
19888
9944
4972

6180196

1545049(1243 Root or Side ſought.
1

22)054
44

244)1050
976

2483)7449
7449

0

The like is to be obſerv'd in a *Circle* and *Elipſis*, by ſquaring the Diameter, or Circumference of the Circle, and the two Diameters ſeverally of the *Elipſis*; and having multiplied or divided by the Number of Times, as more or leſs is required, the Root of theſe Products, or Quotients, gives the Anſwers in whole Numbers and Parts.

There is a Circle 182 in Circumference, and it is required to make another Circle $\frac{1}{4}$ Part of the Bigneſs, what muſt its Circumference be?

182
182

364
1456
182

4)33124(8281(91
81

181)181
181

0

Queſtion. There is an Oval, the longeſt Diameter whereof is 12, and the ſhorteſt 8, and it is deſir'd to make another four Times bigger, what muſt the two Diameters thereof be?

12	8
12	8
144	64
4	4
576(24 Longeſt.	256(16 Shorteſt.
4	1
44)176	26)156
176	156
0	0

To lay out a Circle to any Number of Acres,

The Proportion is,

As 11
Is to 14;
So are the Contents given
To the Square of the Diameter of any Circle.

Queſtion. What is the ſquar'd Diameter, and Diameter of that Circle, which ſhall contain 160 Falls, or one Acre?

As 11 —— 14 —— 160
14

640
160

Sq. Diam. Cir. Diam.
11)2240.0(203.6363 (14.27
1

24)103
96

282)763
564

2847)19963
19929

34

Anſwer. 203.6363, *&c.* is the ſquar'd Diameter, and 14.27 the Diameter of that Circle that ſhall contain 160 Falls, or one Acre. And thus, by the above Proportion, you may lay down a Circle equal to any Square, as near as is neceſſary for Practice: For, by the ſquar'd Diameter, the *Area*, or Contents of any Circle, is found, according to this Proportion,

As 14
Is to 11;
So is the ſquar'd Diameter of any Circle
To the Contents of any Circle.

For Proof, take the Square of the former Diameter, and ſay,

As 14 —— 11 —— 203.6363, *&c.*
11

2036363
20363636

14)2240.0000(160 juſt.

Anſwer, 160, the ſame with the Number of Falls or Poles in one Acre.

To lay down a Sqnare *equal to a* Circle.

The Square Root of the Contents of any Circle, is the neareſt Side of a Square to that Circle.

Example. What is the Side of that Square which ſhall be equal to a Circle containing 5730.49?

. . . . . .
5730.490000(75.699, &c. Root, or Side of the Square.
49

145)830
725

1506)10549
9036

15129)151300
136161

151389)1513900
1362501

1513989)15139900
13625901

1513999
Sic in infinitum.

Proof 75.699, &c.
75.699, &c.

$\frac{1}{9}$ = 8411
9

75700
454200
3785000
52990000

5730.4900

To lay down an Elipſis *equal to a* Circle, *or* vice verſa.

This is no more than to *meaſure* an *Elipſis*, as follows.

Multiply the greater Diameter by the Leſſer, and the Root of that Product is the *mean Diameter*; then ſquare the *mean Diameter*, and ſay, as before,

As 14
Is to 11;
So is the ſquar'd Diameter
To the Contents of the *Elipſis*.

The former Proportions and Queſtions may be applied to any Kind of Meaſure.

Nota, The Circumference of a Circle is found out by its Diameter, thus, As 1 is to 3.141592, ſo is any other Diameter to its Circumference, and, *vice verſa*, as 3.141592, is to 1, ſo is any other Circumference to its Diameter.

Extraction of the Cube Root.

As the *Square* concerns *Superficials*, ſo the *Cube* concerns *Solids*, and is converſant in *Stereometry*; the one has Length and Breadth, the other Length, Breadth, and Thickneſs.

What a *Cube* is, may be conceiv'd from 8 Dies, being plac'd 2 and 2 every Way; and then the Root will be 2, which multiplied by 2, will give the ſuperficial Contents, or Length and Breadth of one of the Superficies; and that again multiplied by 2, will give 8, the ſolid Contents, or Length, Breadth, and Thickneſs of theſe Dies ſo join'd together. Wherefore, any Number multiplied three Times into itſelf, will produce a Number which is called the *Cube Number*, and the Number ſo multiplied into itſelf, is called the *Cube Root* of that *Cube Number*.

Cube Numbers are either *Single* or *Compound*.

A *Single Cube* is that which does not exceed three Places of Figures, and is rais'd from one ſingle Figure, as in the Table.

SINGLE CUBES.

Roots.	*Cubes.*
1	1
2	8
3	27
4	64
5	125
6	216
7	343
8	512
9	729

A *Compound*, is that which has never leſs than four Places, and is always rais'd from a Root of two Figures, as 1000 is a *Compound Cube*, produc'd by the Multiplication of 10, three Times into itſelf.

To extract the Root of any Compound Cube, take this eaſy Method.

Having prepar'd the Number to be extracted, by pointing every third Figure, *that is*, pointing one, and paſſing two, and drawing a Curve on the Right, ſeek the Root of the firſt Period, or *ſingle Cube*; whoſe Root being plac'd in the Quotient, ſubſtract its Cube, and to the Remains bring down the next Figure of the *Reſolvend*, for a *Dividend*, and the Triple of the ſquar'd Quotient will always be the *Diviſor*; the Number of Times this Diviſor is contain'd in the Dividend will be the ſecond Figure of the Root, and the Root, or Quotient cubed, will always be the *Ablatitium*, or Number to be ſubſtracted from the *Reſolvend*; and ſo continue to do, till all the Places in the *Reſolvend* are exhauſted. But note, if the *Ablatitium* ſhall happen to be greater than its *Reſolvend*, take the *Diviſor* a Time leſs. The Rule, then, is in brief this, triple the ſquar'd Quotient for a *Diviſor*, and cube the Root or Quotient for an *Ablatitium*.

Example. What is the Cube Root of 9966.135808?

R E S O L V E N D.

	9	966	135	808(21.52	
	8				
Diviſor 12)	1	9	—	—	1ſt. *Dividend.*
	9	261	—	—	*Ablatitium.*
1323)		705	1	—	*Dividend.*
	9	938	375	—	*Ablatitium.*
138675)		27	760	8	*Dividend.*
	9	966	135	808	*Ablatitium.*

o Remains.

But if, after all the Places in the *Reſolvend* are exhauſted, there are ſtill Remains, add Ternaries of Cyphers, if a *Finite*; and reiterate, or circulate, if an *Infinite*, for bringing out the Root more exactly.

Example

Example of a FINITE.

What is the Cube Root of 187237601 ?

	187	237	601	000	000	000	000	(572.0899
	125							
75)	62	2						
	185	193						
9747)	2	044	6					
	187	149	248					
981552)		88	353	0				
	187	149	248	000				
98155200)		88	353	000	0			
	187	227	783	142	912			
9818265792)		9	817	857	088	0		
	187	236	619	721	140	969		
981857471763)			981	278	859	031		
	187	237	502	394	255	732	699	
			97	605	744	267	301	

Example of an INFINITE.

What is the exact Cube of .037037037 *, &c.

```
            .037|037|037 037 037|(.33333, &c.
              27|   |           |
            ----|   |           |
      27)    100|0  |           |
            ----|---|           |
             35 |937|           |
            ----|---|           |
    3267)      1|100|0          |
            ----|---|---        |
             36 |926|037        |
            ----|---|---        |
  332667)       |111|000 0      |
            ----|---|--- ---    |
             37 |025|927 037    |
            ----|---|--- ---    |
33326667)       | 11|110 000 0  |
            ----|---|--- --- ---|
             37 |035|925 937 037|
            ----|---|--- --- ---|
3333266667)     |  1|111 100 000|0
            ----|---|--- --- ---|---
             37 |036|925 926 037|037
            ----|---|--- --- ---|---
                |   |111 111 000|000
```

Proof .33, &c.

.33

$\frac{1}{3}$=.11, &c. Square.

.33

$\frac{1}{2}$=.037037, &c. Cube.

L. *Use*

Uſe of the CUBE ROOT.

QUeſtions in the *Practice of the Cube*, may be ſolv'd in the ſame Manner as in the *Square*, only with this Difference, That we *cube* here where we *ſquar'd* before, becauſe this concerns *Solids*, the other *Superficials*.

Example. Suppoſe an exact *Cube*, or *Die*, 2 Inches; or, ſuppoſe the Diameter of a Globe to be two Inches, and let it be requir'd to make another 8 Times as big, the Queſtion is, What will be the Diameter of the new Globe?

GENERAL RULE.

Cube the Dimenſions given, and multiply or divide, as more or leſs is required, by the Number of Times demanded, and the Root of the Product will be the Dimenſions ſought for, as in the Work below.

2
2
—
4
2
—
8
8
—
64(4 New Dimenſion ſought.

Example 2. There is a *Ciſtern*, or *Couch*, 5 Foot long, 4 Foot broad, and 3 Foot deep, containing 8 Bolls of Barley; and there is another required to be made 5.832 Times as big; what muſt the Dimenſions of the new Ciſtern be?

5
5
—
25
5
—
125

5.832
125
—
Product 729.000(9 Foot, Length of the new Ciſtern.

The other two Dimenſions may be found out by Proportion; for, as 5 Foot, the Length of the old Ciſtern, is to 4

Foot, its Breadth; ſo will 9 Foot, the Length of the new Ciſtern, be to its Breadth.

5 —— 4 —— 9   5 —— 3 —— 9
      9   3

5)36.0(7.2 Breadth.   5)27.0(5.4 Deep.

After the ſame Manner, having the Dimenſions of any Ship given, and her Tunage, you may find out the Dimenſions of any other of the ſame Mould for any Tunage you pleaſe, by cubing the ſeveral Dimenſions, ſuch as *Keel's Length*, *Hold's Depth*, and *Breadth of the Midſhip's Beam*; and multiplying, or dividing by the Number of Times requir'd, the Root extracted, gives the Dimenſions of the new Ship requir'd.

Or, having found out one Dimenſion, the reſt may be found out by the Rule of Proportion, as in the laſt *Example*.

Or, *Laſtly*, The Dimenſions of a Ship being given, the Dimenſions of another twice, thrice, or four Times, &c. her Tunage may be found out by the Proportion of the Cubes. As, ſuppoſe a Ship of 100 Tuns, being at the Keel 44 Foot long, 20 Foot broad at Midſhip's Beam, and 9 Foot Depth in the Hold; the Queſtion is, What will be the Dimenſions of a Ship of the ſame Mould, twice, thrice, four Times, &c. her Tunage?

		Roots.
Cube Root of	1, being ——	1
	2, or Double, —	1.264
	3, or Triple, —	1.444
	4, or Quadruple,	1.587
	5, or Quintuple,	1.710
	6, or Sextuple,	1.817
	7, or Septuple,	1.913
	8, or Octuple,	2.000

And thus, the Keel of a Ship of 100 Tuns being ſuppoſed to be 44 Foot long, the Length of the Keel for a Ship of 200, 300, 400, &c. may be found out.

For a Ship of
200 Tuns, ſay, As 1.000 : 44 : : 1,264 : 55,616
300 —— 1.000 : 44 : : 1,444 : 63,536
400 —— 1.000 : 44 : : 1,587 : 69,828
500 —— 1.000 : 44 : : 1,710 : 75,240
600 —— 1.000 : 44 : : 1,817 : 79,948
&c.

There is a *Barrel*, containing a *Scots* Gallon, and one is deſir'd of the ſame Caſt to contain 16 Gallons, *that is*, it is to be 16 Times as big as the former.

Take the Diameter at *Bung*, and the Diameter at *Head*, and the Length, and proceed as before directed.

As, ſuppoſe the Diameter at the *Bung* to be 10 Inches, the Diameter at the *Head* 8, and Length of the *Barrel* 14 Inches, work as below.

16 | 000 | 000 (25.2 *fere*, *Bung* Diameter.
8
—— | ——
12) 8 | 0
—— | ——
15 | 625
—— | ——
| 375

The *Bung* Diameter being 25.2 Inches, the reſt may be found out by *Proportion*.

10 —— 25.2 —— 8
8

110)201.6(20.16 Inches at the Head.

10 —— 25.2 —— 14
14

110)352.8(35.28 Inches in Length.

FINIS.

MVSEVM
BRITAN
NICVM